AD-A065 368 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 1/2
COLLISION AVOIDANCE: AN ANNOTATED BIBLIOGRAPHY MAY 1972 - NOVEM--ETC(U)
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UNCLASSIFIED FAA-NA-78-8 NL

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Report No. FAA-NA-78-8

COLLISION AVOIDANCE
AN ANNOTATED BIBLIOGRAPHY
MAY 1972 -NOVEMBER 1977

Dorothy E. Bulford

DECEMBER 1977

FINAL REPORT

Document is available to the U.S. public through
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Springfield, Virginia 22161.

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D.C. 20590

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Technical Report Documentation Page

1. Report No. 14 FAA-NA-78-8

2. Government Accession No.

3. Recipient's Catalog No.

4. Title and Subtitle 6 COLLISION AVOIDANCE: AN ANNOTATED BIBLIOGRAPHY MAY 1972 - NOVEMBER 1977.

5. Report Date 11 Dec[redacted]77

6. Performing Organization Code

7. Author(s) 10 Dorothy E. Bulford, Compiler

8. Performing Organization Report No. FAA-NA-78-8

9. Performing Organization Name and Address
Federal Aviation Administration
National Aviation Facilities Experimental Center
Atlantic City, New Jersey 08405

10. Work Unit No. (TRAIS)

11. Contract or Grant No. 999-113-000

12. Sponsoring Agency Name and Address
U.S. Department of Transportation
Federal Aviation Administration
Systems Research and Development Service
Washington, D.C. 20590

13. Type of Report and Period Covered 9 Final rept. May 1972 - Nov[redacted]77,

14. Sponsoring Agency Code

15. Supplementary Notes 12 320p.

16. Abstract

Collision Avoidance was the subject of a bibliography published in 1968 as FAA report number NA-68-54 (AD 677 942). That report, which contained 1013 citations without annotations, was supplemented in 1972 with the publication of FAA report number NA-72-41 (AD 746 863) which contained 828 annotated references. This collection of 859 references to literature issued since April 1972 further supplements the information found in the two earlier reports.

240 550 Gm

17. Key Words
Aircraft Separation Assurance; Collision Avoidance; Conflicts; Air Traffic Control; Mid-Air Collisions; Near Misses; Intermittent Positive Control; Discrete Address Beacon System

18. Distribution Statement
Document is available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	320	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

79 03 06 023

PREFACE

The Federal Aviation Administration is dedicated to providing a safe and efficient system for the utilization of the national airspace. The prevention of midair collisions is a highly important aspect of the FAA program. To assist both government and the aviation industry in their efforts to devise safeguards against midair collisions, this update of previous compilations was collected.

Collision Avoidance was the subject of a bibliography published in 1968 as FAA report number NA-68-54 (AD 677 942). That report, which contained 1013 citations without annotations, was supplemented in 1972 with the publication of FAA report number NA-72-41 (AD 746 863) which contained 828 annotated references. This collection of 859 references to literature issued since April 1972 further supplements the information found in the two earlier reports.

SOURCES

Air University Library - Index to Military Periodicals
vol. 23 (1972) -- vol. 28, no. 2, April/June 1977

Applied Science and Technology Index 1972 -- Nov. 1977

Government Reports Announcements vol. 72 (1972) -- vol. 77 no. 23, Nov. 11, 1977

International Aerospace Abstracts vol. 12, no. 7, April 1, 1972 -- vol. 17, no. 22, Nov. 15, 1977

NASA Scientific and Technical Aerospace Reports vol. 10, no. 7, April 8, 1972-- vol. 15, no. 21, Nov. 8, 1977

TABLE OF CONTENTS

1. ACAS, BCAS, DABS, IPC, and ASA.

AERO Line 76/025/AERO-04 March 18, 1976. 2p.

Reviews the history of the various efforts and systems for collision avoidance. FAA states that a particular form of BCAS is a better answer than ACAS and this BCAS can be made essentially independent of the ATC system and its IPC.

2. ALPA Calls for Push on CAS.

Air Line Pilot vol. 46, no. 1, p. 33, January 1977.

Jack Howell offers a list of 13 minimum technical and operational criteria he believes any CAS should meet.

3. ANA To File Damage Suit Over Midair Collision.

Aviation Daily vol. 205, no. 36, p. 285, February 22, 1973.

All Nippon Airways will file a $6 million damage suit against Japanese Defense Agency in connection with a midair collision between a 707 and F-86 jet fighter on July 30, 1971 accident in which 162 were killed.

4. AOPA Air Safety Foundation.

How To Avoid a Midair Collision.

AOPA Pilot vol. 16, no. 1, p. 49-56 January 1973.

No pilot is invulnerable to an in-flight collision. The most important guard against such mishaps is to know the limitations of the eye and how to effectively scan for other traffic. The AOPA Scan Training Program was developed by Bray Studios, New York, N.Y., under a grant from the AOPA Air Safety Foundation. It was developed with the assistance of the NTSB, the FAA, NASA, and a number of private companies and individuals who share AOPA's interest in furthering aviation education and flying safety.

5. AOPA Challenges NTSB Findings in Midair Collision.

Aviation Daily vol. 220, no. 28, p. 223, August 8, 1975.

AOPA challenged the NTSB's findings from the investigation of the January 9 collision between an Air Force Convair and a Cessna 150 near Newport News, Va., as "inaccurate, misleading and not supported by the board's own investigative report". AOPA President Joseph Hartranft pointed out that the ground controller handling the Air Force transport had both aircraft in sight on his radar, and had warned the Air Force pilot twice of the other traffic. The Cessna

was not under any radar control. The "see-and-avoid" will not work "unless somebody tries to avoid". "Yet the NTSB continues to ignore this in its reports on midair collisions."

6. ARCON Corporation

IPC Tracker Development.

Contract DOT-FAA74WA-3396, Report R74-3W, October 1974, 63p.

This report describes the technical motivations and conclusions which have led to the design of the IPC track smoothing and prediction algorithm. The IPC tracker, as developed by the FAA, can be suitably modified and extended to provide a superior tracker for IPC applications.

7. ARINC Research Corp.

Technical Investigation of the SSR-CAS Concept and Flight Test Program Requirements. (U)

Report ESD TR-75-76, April 1975, 47p., AD-B004 994L (USGO)

8. ATC Blamed for Spokane Near-Miss.

Flight Operations vol. 66, no. 5, p. 49, May 1977.

A Hughes Airwest DC-9, executing a missed approach at Spokane Airport on April 1, 1976, almost struck a Northwest DC-10 taking off from the same runway because the tower controller did not know the exact position of the DC-9 when he cleared the widebody for departure.

9. Aarons, Richard N.

Aircraft Separation Assurance for Tomorrow.

Business and Commercial Aviation vol. 38, no. 5, p. 52-56, May 1976.

The FAA Aircraft Separation Assurance Program consists of five major elements:

1. Integration of Conflict Alert Capability into software packages at computerized ATC centers and terminal control facilities.
2. Drafting of new flight plan requirements.
3. Extending the mandatory use of transponders and altitude encoders in ever larger protions of the airspace.
4. Developing a technical standard for an Airborne Beacon Collision Avoidance System (BCAS).
5. Implementation of Intermittent Positive Control (IPC) through development of the Discrete Address Beacon System (DABS).

10. Aarons, Richard N.

The Search for a Lighting Standard.

Business & Commercial Aviation vol. 36, no. 5, p. 45-49, May 1975.

"The entire point of improving aircraft lighting systems is obviously collision avoidance, and there are many elements in the collision avoidance equation other than lighting. But one significant tie should be kept in mind. Despite the fact that FAA believes the basic collision prevention tool should be ground-based radar or cooperative collision warning systems (CWS), many commenters, including NBAA and ALPA, still are hoping for a proximity warning indicator (PWI) system based on detection of infrared radiation from strobe lights. The beauty of such a system, say its proponents, is simplicity: all airplanes would be equipped with strobes. Those operators who wished to make an additional investment would purchase a PWS, which detects the proximity of strobe lights, and thus other airplanes."

11. Abelshauser, L.

Near Misses -- A critical discussion on an important topic.

Flug Revue/Flugwelt International March 1972, p. 25-28 (In German)

Near misses within German airspace are considered. After presenting a report on the current situation, detailed attention is given to IFR/IFR air misses (including coordination of ATC stations, problems due to equipment failure, personal and planning problems), and to IFR/VFR air misses. Finally, measures are suggested for decreasing the risk of aircraft collisions. The measures include the introduction of air traffic flow control on an international basis, specific airspace for military VFR traffic, and collision avoidance systems in aircraft. Some advanced collision avoidance systems are briefly characterized.

12. Accident Reviews Prompt NTSB Recommendations.

AOPA Pilot vol. 15, no. 6, p. 71-74, June 1972

As an outgrowth of accident investigations involving three in-flight collisions, a near miss, a flat spin resulting in a fatal crash, and an in-flight fire, the National Transportation Safety Board recently issued a number of safety recommendations of interest to pilots.

13. Adams, Art

Near-Midair.

Approach vol. 22, no. 8, p. 5, February 1977.

Short record of a near-miss involving a helicopter and two S-3s in California. He states that a jet pilot must be alert for slow helo and prop traffic in the vicinity of airports. That pilot also has a moral responsibility to relieve any anxiety of the other pilot, as much as possible, by acknowledging any signal and by giving the other aircraft wide clearance -- 500 feet vertically or 1 mile laterally.

14. Adams, J. E., Ax, G. G. and Jennings, R. D.

Compatibility of Systems in the 1600 MHz Region.

In: EMC at the Crossroads; International Electromagnetic Compatibility Symposium, Arlington Heights, III., July 18-20, 1972, Record. N.Y. IEEE, Inc., 1972. p. 32-38.

Review of recent work at the Institute of Telecommunication Sciences (ITS) which is representative of three classes of system development; operating radar altimeters, developed prototype collision avoidance systems (CAS) equipment, and proposed general specifications for air and marine mobile satellite communications. Collision avoidance systems are either of the time-frequency type or use a transponder technique.

15. Adams, J. E., Ax, G. G. and Jennings, R. D.

The Impact of the Air Transport Association of America/ATA/Collision Avoidance System on the 1600 MHz Aeronavigation Band.

In: Annual International Conference on Communications, 8th, Philadelphia, Pa., June 19-21, 1972, Conference Record. New York, IEEE, 1972. p. 20-20 to 20-24.

The effects of different types of possible interfering electromagnetic signals on the collision avoidance system (CAS) are examined. This CAS operates only with other aircraft that have similar equipment as a cooperative system. There are six radar altimeters (four military and two civilian) designed for use in the 1600 MHz band. They are of the pulsed carrier and frequency-modulated continuous wave (CW) types. It is shown that certain radar altimeters can operate under normal FAA aircraft separation rules with less than 50% reduction in CAS performance parameters.

16. Advisory Group for Aerospace Research and Development.

Air Traffic Control Systems.

AGARD-CP-105 Presented at the 14th Meeting of the Guidance and Control Panel of AGARD. Edinburgh June 26-29, 1972, 371p. N73-23689. In English and FRENCH.

The subjects discussed involve the following:
(1) control concepts; (2) automation; (3) area and enroute navigation; (4) terminal navigation and control; (5) landing guidance; (6) surveillance; (7) communications; (8) collision avoidance; (9) integrated communication, navigation and identification system.

17. Aeronautical Radio, Inc.

Air Transport Time-Frequency Collision Avoidance System.

ARINC Characteristic no. 587-4, December 11, 1973, 153p., plus 4 Supplements

This document sets forth the basic requirements for a time/frequency collision avoidance system (CAS) specifically designed for installation in all types of commercial transport aircraft. The specification for this Characteristic may be found in the Air Transport Association of America's ANTC Report no. 117.

18. Aeronautical Radio, Inc.

Limited Level 1 Time/Frequency Collision Avoidance System.

ARINC Characteristic 590, May 26, 1972, 42p., Supplement 1, April 20, 1973, 30p.

This document describes the airborne components of a Collision Avoidance System of the Limited Level 1 type specified in the Air Transport Association of America's ANTC Report No. 117. This system has full hazard logic and is capable of operating at sub-sonic jet altitudes and velocities, but it is not required to pass on system time.

19. Air Collision Kills 67 in France During a Strike of Controllers.

New York Times vol. 122, p. 1, 7, Tuesday March 6, 1973.

Two Spanish jetliners, flying over western France during an air controllers' strike, collided in "fine, clear weather." One made a safe emergency landing, while the other crashed, killing all 67 persons.

20. Aircraft In Midair Were Both Flying VFR.

Aviation Daily vol. 202, no. 1, p. 3, July 3, 1972.

An Air Wisconsin Twin Otter and a North Central Convair were involved in a midair collision the last week of June over Lake Winnebago, Wis.

21. Airline Air Traffic Control Committee, CAS Technical Working Group.

Airborne Collision Avoidance System; An Airline Industry Document to provide the Statement of Airline Policy and Requirements and a Technical Description of the System.

Air Transport Association of America, Air Navigation/Traffic Control Division ANTC Report no. 117, revision ten corrected through March 24, 1972.

Attachment 1 consists of CAS Equipment Standards.

22. Airlines Electronic Engineering Committee.

BCAS As A Element of Aircraft Separation.

AEEC Letter 76-034/CAS-30 April 9, 1976 6p.

FAA has proposed the development of a new CAS, deriving its threat evaluation data from the ATCRBS, that will become an element of a complex aircraft separation assurance system. This describes the three proposals put forward for the design of such a CAS, the third of which functions within the yet-to-be-confirmed-for-implementation DABS derivative of the ATCRBS.

23. Airlines Electronic Engineering Committee.

Proceedings of "Beacon-Based Separation Assurance Systems" Seminar.

AEEC Letter N76-106/AXX-00 October 11, 1976 36p.

Reproductions of the 7 papers given at the seminar that followed the Fall 1976 AEEC General Session in Munich.

24. Airlines Electronic Engineering Committee.

Proposed Minor Modifications to ARINC Characteristics 587 and 590.

AEEC Letter 73-029/CAS-27 February 21, 1973 3p.

Suggested changes by Boeing concerning failure warning signals from the two central air data computers (CADC's) feeding the Collision Avoidance Unit (CAU).

25. Airmiss Upswing.

Flight International vol. 102, no. 3307, p. 115, July 27, 1972.

The report of a German Government inquiry states that there are approximately 350 airmisses annually in German airspace. There are five or six dangerous airmisses every month. On one occasion radar controllers at Stuttgart counted 200 unidentified aircraft within a 20-mile radius of the airport.

26. Airplanes Collide Over ....!

MAC Flyer vol. 21, p. 7-9 April 1974.

Prototype systems being tested --- Collision Avoidance System (CAS) and Pilot Warning Indicators (PWI). Adapted from ICAO Bulletin November 1973.

27. Amlie, T. S.

An Aeronautical Beacon System Using Precise Time.

IN: NASA. Goddard Space Flight Center. Proceedings of the 5th Annual NASA and DOD Precise Time and Time Interval Planning Meeting. Greenbelt, Md., 4-5 December 1973. Sponsored by Naval Electronic Systems Command and Naval Observatory. NASA-TM-X-70773 p. 349-367 N 75-11275#.

An experimental system using precise time techniques will provide accurate surveillance data to the ground based ATC sensors, high capacity data link ground-to-air and air-to-ground, navigation services and air-to-air collision avoidance and proximity warning service. The design takes into account the large disparity in electronic equipment among the various classes of users. The user of the airspace installs only that equipment required for the services he needs.

28. Amlie, T. S.

SYNCHRO-DABS.

AIAA Digital Avionics System Conference, Boston, Mass., April 2-4, 1975. Paper 75-549 7p.

The FAA is developing a Discrete Address Beacon System (DABS) as a replacement for the present radar beacon system. This paper describes an experimental system which has been built and tested and which performs the functions of the present radar beacon system, the DABS with integral digital data link, an air-derived proximity warning indicator, an air-derived collision avoidance system, a Distance Measuring Equipment (DME) and a microwave landing guidance system, all with one airborne 'black box'.

29. Amlie, Thomas S.

A Synchronized Discrete-Address Beacon System.

FAA, Office of Systems Engineering Management Report no. EM-74-3 October 1973 10p. N74-10622# AD770794.

IEEE Trans. vol. COM-21, no. 5, p. 421-426, May 1973.

The SYNCHRO-DABS provides a method of introducing the DABS function into the ATC system so that it is completly compatible with the ATCRBS. It also provides additional navigation and collision-avoidance services to those operators who desire it. A key point is that the location of all aircraft with the basic minimum DABS transponder can be displayed to the pilot of any aircraft that has the optional air-derived collision-avoidance equipment.

30. Anderson, E. W.

Information Theory Approaches to Navigation. I. A Prospect of Navigation.

Journal of Navigation vol. 25, p. 141-152, April 1972.

The philosophy underlying current navigation procedures is discussed in terms of information theory. The concept of entropy is introduced as a measure of randomness, and its reduction through the work performed by the navigator is examined. The basic concepts are illustrated and applied to problems of traffic control. The problem of collision avoidance is reviewed, along with the procedures of traffic control communications. The capabilities and limitations of the computer as an aid in traffic control are assessed.

31. Andrews, J. W.

Air-to-Air Visual Acquisition Performance with Pilot Warning Instruments (PWI).

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72WAI-261 FAA Report no. RD 77-30 April 25, 1977 66p. AD-A039 714 N77-27098#

Flight tests conducted at Lincoln Laboratory have produced new data characterizing the ability of general aviation pilots to visually acquire potential collision hazards when by Pilot Warning Instruments (PWI). Performance predictions for a wide variety of aircraft sizes, approach speeds, and visibility conditions are presented.

32. Andrews, J. W. et al

Plan for Flight Testing Intermittent Positive Control.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72WAI-261 FAA Report RD 74-210 (ATC-46) June 1975 110p. AD-A014 040 N76-13047#

Intermittent Positive Control is an automated aircraft collision avoidance system requiring the participation of the aircraft pilots involved. The operational interface between pilots and the IPC system is being evaluated in a series of live flight tests. This

document describes the objectives and methods of the IPC flight testing being conducted by Lincoln Laboratory.

33. Andrews, J. W. and Koegler, J. C.

IPC Design Validation and Flight Testing -- Interim Results.

Massachusetts Institute of Technology, Lincoln Laboratory Contract no. DOT-FA72WAI-261 FAA Report no. RD 76-22. (ATC-57) March 16, 1976 108p. AD-A024 935 N76-28214#

Intermittent Positive Control, an automated aircraft collision avoidance system requiring the participation of the aircraft pilots involved, was evaluated in a series of live flight tests. This document provides an interim summary of the results obtained in these flight tests. Results are given for IPC logarithm design evaluation flights (34) and for pilot interaction evaluation flights (14) flown from Hanscom Field, Bedford, Mass., between February and October 1975.

34. Andrews, J. W. and Prado, G.

The Influence of Surveillance System Parameters on Automated Conflict Detection and Resolution.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72WAI-261 FAA Report RD 72-100 November 29, 1972 56p. AD 753 407

The effects of sensor accuracy, data rate, and message delivery delay upon automated conflict detection and resolution processing is analyzed and particular considerations for DABS/IPC operation are discussed. Various options in the design of the algorithmic logic are enumerated and a particular logic is chosen for quantitative inspection. Performance sensitivity calculations for the conflict detection and command generation functions are then presented. The influence of algorithmic logic and traffic environment upon surveillance requirements is delineated.

35. Andrews, John W.

IPC/PWI Message Rate Study.

Massachusetts Institute of Technology, Lincoln Laboratory Air Force Contract no. F19628-73-C-002 ATC Working Paper no. 41WP-5012 January 3, 1974.

This Working Paper contains information of a tentative nature and has not been cleared for dissemination outside the FAA.

36. Angstadt, H. B.

NAFEC Operational Test and Evaluation of ARTS III Conflict Alert Stage I.

FAA, NAFEC Technical Letter Report NA-77-48-LR September 1977 8p.

This report describes the operational evaluation of the conflict alert function when interfaced with the Terminal ARTS III system. Tests were conducted at NAFEC in a terminal environment laboratory with simulated aircraft target data. Tests were designed to evaluate the performances of the conflict alert function with respect to detection capability and adequacy of warning provided. Results indicate that the conflict alert function is operationally suitable when integrated with the ARTS III system and is a desirable backup feature for the air traffic controller.

37. Arellano, Gus

The Ultimate in Air Pollution.

MAC Flyer vol. 20, no. 3, p. 8-9, March 1973.

Airspace congestion, mixed VFR-IFR traffic, ATC mix-ups, heads in the cockpit -- four causes of midair collisions.

38. Army Orders More Proximity-Warning Units.

Journal of Air Traffic Control vol. 15, no. 5, p. 38, September/October 1973.

The Army plans to extend use of aircraft proximity warning systems to hundreds of training helicopters at four major bases to increase pilot's ability to prevent midair collisions. A $3.2 million contract has been awarded to Honeywell. The FAA awarded a $525,000 contract to them for flight test and evaluation of the system's potential for commercial use.

39. Assessing Collision Avoidance Systems.

Aircraft Engineering vol. 44, no. 4, p. 7, April 1972.

Briefly reviews the 3 systems described in the January, February and March issues. The EROS II L-band time-frequency based system, the Honeywell YG1081 C-band Collision Warning System and SECANT, a non-synchronous L-band system.

40. Athans, M.

Applications of Modern Control Theory to Scheduling and Path-Stretching Maneuvers of Aircraft in the Near Terminal Area.

Massachusetts Institute of Technology, Electronic Systems Laboratory Report no. ESL-R-574 NASA-CR-142058 October 1974 28p. N75-15626

A design concept of the dynamic control of aircraft in the near terminal area is discussed. An arbitrary set of nominal air routes, with possible multiple merging points, all leading to a single runway, is considered. The system allows for the automated determination of acceleration/deceleration of aircraft along the nominal air routes, as well as for the automated determination of path-stretching delay maneuvers. In addition to normal operating conditions, the system accommodates: (1) variable commanded separations over the outer marker to allow for takeoffs and between successive landings and (2) emergency conditions under which aircraft in distress have priority. The system design is based on a combination of three distinct optimal control problems involving a standard linear-quadratic problem, a parameter optimization problem, and a minimum-time rendezvous problem.

41. Avant, Arnold

IPC Alogrithm Development for IFR/VFR Encounters.

Mitre Corporation, METREK Division Contract DOT-FA70WA-2448 Technical Report MTR-7277 September 1976 55p.

This paper reveals the development and rationale of the IPC algorithm in encounters between DABS equipped aircraft of mixed control categories. Algorithm performance in straight and level near-miss conflicts is assessed, with preliminary results indicating considerable sensitivity to tracker type, turn sensing thresholds and surveillance data quality.

42. Avant, Arnold L.

Performance of IPC and ACAS in Simulated Chicago O'Hare Airspace.

Mitre Corportation Contract DOT-FA70WA-2448 Technical Report MTR-6712 March 1975 52p.

This report presents the results of estimating the interaction of the IPC algorithms with the ATC system and comparing this interaction with that of airborne collision avoidance systems. The basic objectives were to refine the existing IPC algorithms to a stage where they would be a useful debarkation point in NAFEC's ATC compatibility studies, to obtain a preliminary assessment of the algorithms' performance using DABS surveillance accuracies and IPC tracking and to compare IPC and ACAS in identical traffic scenarios.

43. Avant, Arnold L.

Procedural Feasibility of Reduced Spacings Under VAS Operation at O'Hare.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-7415 May 1977 54p.

The Vortex Advisory System (VAS) is designed to determine when meteorological conditions are such that the dispersal and/or breakup of vortices permit a reduction in IFR longitudinal separation standards to three nautical miles for all aircraft pairings along some portion of the final approach segment of terminal flight.

44. The Aviation Safety Institute

Much More Could Be Done: A Quarterly Report on Aviation Safety.

Report no. 74-2 July 1, 1974 91p.

This report summarizes the results of a three month review of data obtained by anonymous reporting of unsafe acts and unsafe conditions within the National Airspace System. ASI has concluded that there are glaring deficiencies within the air traffic control system and at many of the major U.S. airports. "There appears to be a significant correlation between ATC facilities that report staffing and operating procedure problems and the occurrance of near-misses and other hazardous events. The greatest threat to loss of lives is still the midair collision. It is likely that the possibility for a midair accident of major magnitude will increase unless the FAA takes positive action to correct problems and decelerates the implementation of a new automated control system known as RDP (radar data processing)."

45. BCAS Improvements

Aviation Week & Space Technology Vol. 108, no. 2, p.73, January 9, 1978.

Litchford Electronics has been awarded a sole-source contract to upgrade two experimental Beacon-Based Collision Avoidance Systems (BCAS) now under test by FAA, NAFEC.

46. Bagnall, J.J., Jr.

Collision Avoidance — The State of the Art and Some Recent Developments and Analyses.

Navigation vol. 23, p.262-273, Fall 1976.

Little progress toward operational use is reported in this survey of airborne collision avoidance systems (CAS), covering both beacon-only and time-frequency techniques. ANTC-117 logic, air traffic control radar beacon systems (ATCRBS) applied to collision avoidance, threat criteria and altitude criteria, and algorithms for separation distance calculations and altitude difference calculations are discussed.

47. Bagnall, J.J.,Jr. et al

A Review and Analysis of the Mitre Beacon Collision Avoidance System.

Institute for Defense Analyses Contract DOT-FA74WA-3498 Study S-481
FAA Report RD 77-2 October 1976 209p. AD-A037 225 N77-24090#

Analyses the MCAS which is an active CAS compatible with DABS. It relies on the use of ATCRBS transponders, but because the system is active, its design must assume that airborne MCAS interrogator equipment will be limited to about ten percent of the flying population in order to avoid excessive garble for its own purposes and interference with regular ATCRBS ground stations. IDA states that MCAS cannot operate successfully in traffic densities as high as half that projected by the FAA for the Los Angeles Basin in 1982.

48. Bagnall, James J., Jr., et al

A Review and Analysis of the RCA Collision Avoidance System, Phase I.

Institute for Defense Analyses Study S-426 FAA Report RD 73-152
October 1973 192p. AD-A022 112 N76-23183#

This study analyzes two collision avoidance systems (CAS) using RCA SECANT techniques: VECAS designed for high performance aircraft and VECAS-GA designed for low performance aircraft. The two CAS use the Air Transport Association collision avoidance logic and were evaluated in the 1971 FAA projection of traffic (800 aircraft) in 1982 Los Angeles basin. The CAS are asynchronous and employ beacon interrogator/transponder techniques, which introduce mutual interference. In the analysis a third equipment, the SECANT Proximity Warning Indicator (PWI), was modeled but not analyzed to determine levels of interference.

49. Bagnall, James J., Jr., Dausin, Lawrence R. and Turner, Robert D.

A Review and Analysis of the Honeywell Collision Avoidance System.

Institute for Defense Analyses Study S-424 FAA Report RD-73-151
October 1973 2 vols. AD-A021 949, AD-A021 950 N76-23184#, N76-23185#

This study analyzes two collision avoidance systems (CAS) developed by Honeywell: AVOIDS-1 designed for high performance aircraft and AVOIDS-2 designed for low performance aircraft. Both CAS were still undergoing refinements as of early 1973; therefore, the results reported here apply only to the specific versions studied. The two CAS use the Air Transport Association collision avoidance logic and were evaluated in the 1971 FAA projection of traffic (800 aircraft) in 1982 Los Angeles basin. No attempt was made to evaluate the operational suitability of the ATA logic in the projected traffic. The CAS are asynchronous and employ beacon interrogator/transponder techniques, which can lead to mutual interference among the CAS.

50. Bagnall, James J., Jr. and Kay, Irvin W.

A Review and Analysis of the Litchford Beacon Collision Avoidance System.

Institute for Defense Analyses Contract DOT-FA74WA-3498 Report FAA-RD 77-1 (S478) October 1976 222p.

Presents the results of IDA's study and analysis of the Litchford Associates concept. LCAS belongs to the Beacon Collision Avoidance System and is compatible with ATCRBS. LCAS has a passive mode that permits estimates of the relative bearing of equipped intruder aircraft but does not stimulate interference to ATCRBS. LCAS can experience severe synchronous interference or garble in high-density aircraft traffic. In fact, when peak traffic densities are as high as those which have already been observed in the Los Angeles Basin, the problem will be severe enough to deny proper altitude decoding 18 percent of the time by the LCAS.

51. Bagnall, James J., Jr. and Kay Irvin W.

Review and Analysis of Some Collision Avoidance Algorithms with Particular Reference to ANTC-117.

Institute for Defense Analyses Contract DOT-FA74WA-3498 Study S-450 FAA Report RD 75-72 June 1975 175p. AD-A021 635 N76-23233#

Since 1971, Revision 10 of ANTC Report 117, issued by Air Transport Association of America, has served as the unofficial standard for cooperative midair collision avoidance systems. This paper presents the results of an assessment of those parts of ANTC-117 that deal with threat evaluation and maneuver selection logics. Of primary concern were two questions: (1) whether the threat evaluation logics of ANTC-117 provide sufficient time for performing maneuvers necessary to achieve safe separation and (2) whether in dense traffic the expected number of alarms occur infrequently enough for the CAS to be practical. The answers to both questions were found to be negative.

52. Bagnall, James J., Jr. and Kay, Irvin W.

A Review and Analysis of the RCA Collision Avoidance System -- Phase II.

Institute for Defense Analyses Contract DOT-FA74WA-3498 Study S-462 FAA Report RD 75-152 October 1975 108p. AD-A021 672 N76-23244#

This study is an analysis of how well RCA's aircraft collision avoidance system, known as the SECANT VECAS and the SECANT VECAS-GA, will perform in the high density traffic forecast for the Los Angeles Basin in 1982. The equipment meets the relevant specifications and otherwise conforms to the intent of ANTC-117.

53. Bailey, Marion C. and Croswell, William F.

Stacked Array of Omnidirectional Antennas. Patent.

US-Patent-Appl-SN-31703: US-Patent-Class-343-771: US-Patent-Class-343-893. January 25, 1972 5p.

A stacked collinear array of independently fed omnidirectional antennas is described for use in collision warning systems of commercial aircraft. Each antenna consists of a dielectric filled coaxial transmission line with a uniform array of circumferential slots in the outer conductor. A sleeve balun is attached to each end of the transmission line for pattern control in the elevation plane and to provide some degree of isolation between antennas. Each antenna, except the top one, has a hollow center conductor of sufficient size to accommodate the feed cables for all antennas above it, thus eliminating a cable interference problem.

54. Baker, C.B.

Civil Airmiss Situation Analyzed in U.K. Study.

ICAO Bulletin vol. 30, no. 7, p.26-29, July 1975.

Findings in this recent study of long term data indicate that airmisses can provide a practical monitor of ATC system effectiveness. The study was done in the United Kingdom by members of the Civil Aviation Authority — CAA Paper no. 75001, January 1975.

55. Ball, R.G., Lloyd, R.B. and Ord, G.

Computer Assisted Conflict Resolution in Air Traffic Control.

R.R.E. Newsletter & Research Review No, 13, p. 29/1 - 29/3, (1974)

In: Plans and Developments for Air Traffic Systems. Papers presented at the 20th Symposium of the Guidance and Control Panel, held in Cambridge, Massachusetts, 20 - 23, May 1975. AGARD Conference Proceedings No, 188, Paper 17. 14p.

The controller needs computer assistance to display the predicted trajectories the pilots intend to fly. Such a display can be used to warn the controller when two aircraft are in potential conflict and to suggest how any such conflict might be resolved.

56. Banks, James R.

Collision Avoidance By the Seat of Your Pants.

Journal of Air Traffic Control vol. 17, p.14-15, October-December 1975.

The majority of midair and near midair collisions occur below FL 180. There should be some immediate regulatory actions toward giving a VFR pilot the capability to help in his own collision avoidance.

57. Bates, M. and Michnik, L.

Selection of Existing Navigation Aids as Vehicles for Providing Synchronization.

Sierra Research Corp. Contract DOT-FA71WA-2571 Report TR-867 May 21, 1971 21p.

Reviews and compares the two alternative synchronization vehicles and explains the considerations that led Sierra to use of VORTAC.

58. Bates, M. and Scott, W.

Selection of VORTAC System Approach for Providing Synchronization.

Sierra Research Corp. Contract DOT-FA71WA-2571. Report TR-0868 May 24, 1971 36p.

Sierra Research Corporation proposed two basic techniques of synchronizing airborne clocks to existing navigation aids. Both techniques relied on the DME portion of VORTAC to provide the required distance-to-station information. This report recommends the approach to be taken. Included are the selection criteria followed by a discussion of approach considered, signal format, hardware considerations, hardware differences, error analysis, and the recommendations.

59. Bates, M.R., Moore, L.D., and Scott, W.V.

Design Study of General Aviation Collision Avoidance System.

Sierra Research Corp. TR-0913A NASA-CR-112023 March 1972 243p. N72-21625

The selection and design of a time/frequency collision avoidance system for use in general aviation aircraft is discussed. The modifications to airline transport collision avoidance equipment which were made to produce the simpler general aviation system are described. The threat determination capabilities and operating principles of the general aviation system are illustrated.

60. Battle of the Collision Avoidance Systems.

Business & Commercial Aviation vol. 30, no. 6, p.36, June 1972.

Honeywell has a transponder-type system called AVOIDS (Avionic Observation of Intruder Danger Systems). Two levels of CAS equipment are available -- one for commercial airlines and one for general aviation and low-performance military aircraft.

61. Baudry, H.G.

Proposed Partial and Interim Solution to Reduce Vertical Separation Above FL290

International Civil Aviation Organization. Review of the General Concept of Separation Panel (RGCSP) RGCSP-WP/54 Montreal August 1975.

62. B/CA's Viewing Area Grid System.

Business and Commercial Aviation vol. 37, no. 3, p.62-64, September 1975.

Aircraft collision studies show that effectiveness of the see-and-avoid concept is governed by cockpit viewing area. VAGS provides an anlytical tool for objectively grading "cockpit visibility". Describes how it works.

63. Beacon-based, Collision-Avoidance System Approved.

Aviation Week & Space Technology vol. 107, no. 12, p. 65, September 19, 1977

Transportation Dept. has approved FAA's three-phase program to develop a national standard, beacon-based, collision-avoidance system. Initial phase will be a multi-contractor design study, followed by selection of two contractors to build demonstration hardware, with a single contractor selected for final prototype hardware fabrication. The present tentative timetable calls for a request for proposals to be issued in October or November, 1977.

64. Bean, John B.

Statement of the Chairman of the Board, National Business Aircraft Association, Inc.

U.S. Congress House Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems, Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 173-178.

He stressed that NBAA is equally concerned with the controlled high-speed, high-altitude environment as it is with the low-level, low-speed airport areas where NTSB reports that most midair collisions occur. Collision avoidance systems provide the pilot with an avoidance maneuver. He need never see the intruder and at high speeds probably will not. At 1,200 mile per hour closure speeds, CAS equipment must function at extended ranges of 40 to 50 miles, in all kinds of weather, and to be truly effective must provide maneuver information to both aircraft.

65. Belcher, B.W. and Penna, D.M.

A Statistical Study of Midair Collisions Involving Public Transport and Executive Jet Aircraft, 1946-1975 World-Wide.

Great Britain, Civil Aviation Authority paper 76041 (DORA research paper 7508)

The report concludes: "The worldwide collision rate is substantially constant over the 30 years for which records are available. This indicates that the improvement in the quality of air traffic services nullified the increased risk due to the greater air traffic."

66. Bellantoni, Juan, F.

The Calculation of Aircraft Collision Probabilities.

Transportation Systems Center Report TSC-FAA-71-27 October 1971 41p. AD 744 722 N73-10046 and N72-20997#

This paper extends the statistical-probabilistic method of collision probability calculation, which has been limited to parallel, straight line flight paths, to arbitary flight paths and vehicle shapes. The general formula is specialized to the cases of large relative velocity, non-zero relative velocity, zero relative velocity, and spherical collision surface. The formulas are applied to independent curved landing approaches to parallel runways.

67. Bennett, J.W. and Gent, H.

The Application of an Index of Orderliness to a Collision Avoidance System.

Royal Radar Establishment RRE-Memo-2913 January 1975 23p. (DOD Only)

68. Besson, J. and Boillot, J.

Guidance of Aircraft According to Techniques of Trajectory Plotting with a Clock.

In: Electronics and Civil Aviation; International Conference, Paris, France, June 26-30, 1972, Reports. Volume 2, p. 812-827. (In French)

69. Besson, J. and Sannier, P.

Developed Methods of Synchronisation of Navigation and Collision-Avoidance Systems.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany, October 2-5, 1973. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 2. 23p.

Certain navigation and collision-avoidance systems, both aeronautical and maritime, use the time-frequency technique. The modus operandi depends on maintaining a common time scale over a high degree of precision in the common time scale. ONERA has developed original methods of synchronization based on the use of a reference clock carried by an aircraft overflying the positions in which the clocks to be synchronized are located. The transmission of time between the station clocks and the reference clock can be effected by RF link or by optical (laser) link. Results are presented with details of the accuracies obtained. (Author)

70. Birds of a Feather. How the "keep 'em high" program at terminals separates the big boys from the little ones.

FAA Aviation News vol. 11, no. 2, p. 3. June 1972

A significant reduction in the number of near midair collisions reported to FAA has been noted since the policy of having high performance aircraft approach busy terminals at higher altitudes (than slower VFR aircraft) was instituted in 1971.

71. Blair, B.E. and Morgan, A.H., eds.

Precision Measurement and Calibration. Selected NBS Papers on Frequency and Time.

National Bureau of Standards Special Publication 300, vol. 5. June 1972 565p.

This volume gives broad coverage to work in the area of frequency and time for the decade 1960-1969. The papers given in the first four sections show advances in atomic frequency and time scale standards, statistical means of time synchronization and methods of frequency and time dissemination, including satellities and TV timing. Section V.5, provides selected worldwide references of frequency and time, classified by area, written during the period 1960 to 1970.

72. Blake, Francis M.

Analysis of DABS Site Configuration Alternatives for Phase II Testing at NAFEC.

Mitre Corp. Contract DOT-FA70WA-2448 Report MTR-6551 February 14, 1974 41p.

DABS and IPC concept testing is to be conducted in two phases; phase I was to begin in the early 1974 and phase II was scheduled to begin in July 1976. This report examines potential hardware site configuration alternatives for the NAFEC phase II tests and provides specific recommendations concerning the use of existing equipment in the test-bed.

3. Blake, N.A.

New ATC Functions Using DABS.

In: Air Traffic Control Association, Annual Meeting and Technical Program, 17th, Chicago, Ill., October 9-11, 1972, Proceedings. Washington, D.C., ATCA, 1973. p. 23-27

The Discrete Address Beacon System (DABS) which (when implemented) will serve the dual purpose of providing aircraft position data and of exchanging digital messages between the ground-based ATC computer and the aircraft is discussed. These messages concern such controller functions as metering, sequencing, and spacing aircraft, and the prediction and resolution of conflicts involving IFR and VFR traffic.

A separation minima warning system developed for use until DABS has been introduced is described. The SYNCHRO DABS concept, currently under study and evaluation, which represents an extension of the basic DABS to provide a compatible air-to-air PWI-CAS mode of operation to properly equipped users, is examined.

74. Blake, N.A.

Plans for Intermittent Positive Control Improved Beacon and Other Features of the Upgraded Third Generation System.

In: Upgrading the ATC System; Proceedings of the Annual Meeting, Washington, D.C., November 28, 29, 1973. Washington, D.C., Radio Technical Commission for Aeronautics, 1973. 68p.

The FAA plans and programs for implementing the recommendations of the Air Traffic Control Advisory Committee are discussed. It is intended to develop the present ground-based ATC system which uses the ATC radar beacon system to a system that will make use of increased levels of automation. Attention is given to the advanced air traffic management system, the airborne CAS, the discrete address beacon system, ATC automation problems, central flow control, automation, ground surveillance and control, and solutions regarding tracking wake vortices.

75. Blake, N.A.

A Synchronized Discrete Address Beacon System.

In: International Telemetering Conference, Washington, D.C., October 9-11, 1973, Proceedings. Pittsburgh, Pa., Instrument Society of America. 1973. p. 12-17

This paper describes a particular implementation of the DABS concept which also provides air-to-air collision avoidance service and and navigation service.

76. Blank, Howard A.

System Design Study for VHF Universal Data Link and DABS Combinations.

Computer Sciences Corp. Contract DOT-FA72WA-3072 FAA Report RD76-13
February 1976 325p. AD-A029 547

This final report presents the results of a preliminary design of a VHF Universal Data Link System. Also presented are preliminary estimates of the design of the judicious selection of appropriate combinations of VHF Data Link and DABS coverage. The results of the study indicate that a VHF Universal Data Link System will greatly upgrade the capabilities of the current air/ground communication system. The implementation cost and complexity appear favorable when compared to the increased communications benefits.

77. Blanke, L.R.

Time/frequency Collision Avoidance Systems.

Tech Air vol. 28, p. 4-9 March 1972

The system EROS II is discussed together with the aspects of synchronization, air-to-air synchronization, the back-up-mode, threat logic, and landing aid operations.

78. Blodget, Robert

Black Boxes Can't Stop Midairs.

Flying vol. 90, no. 5, p. 42-45, 94-95 May 1972

In the real world of today, we can reduce -- or preferably eliminate -- the majority of midairs, by doing some of the following:

1) The use of strobe lights
2) A combination transponder and encoding altimeter
3) The adoption of a standard traffic pattern or the faithful observance of existing patterns, at the uncontrolled airports.
4) Look to both sides and move your line of sight fore and aft, which would have the effect of making the stationary target appear to move.
Pilots should maintain a proper watch when aloft.

79. Blouin, James E.

Synchronized Time and Frequency for Aeronautical Collision Avoidance, Communication, Navigation and Surveillance.

Journal of Aircraft vol. 9, no. 5, p. 323-324, May 1972

Condensation of CASI Paper 72/17 at the 12th Anglo-American Aeronautical Conference, Calgary, Alberta, Canada, July 7-9, 1971. Full paper available from NTIS as N72-70171. Abstracted as Reference #90 in Bibliography, FAA-NA-72-41, June 1972.

80. Board Reports on Near Miss at Spokane.

Aviation Week & Space Technology vol. 106, no. 11, p. 57, 59, March 14, 1977; vol. 106, no. 13, p. 59, 61, March 28, 1977

Report by NTSB on the near midair of a Hughes Airwest McDonnell Douglas DC-9 and a Northwest Airlines McDonnell Douglas DC-10 over Spokane, Wash., International Airport, April 1, 1976. The causal factors are related either to flight operational deficiencies or to ATC procedural deficiencies, or to both. The separation procedure used did not provide positive separation between arriving and departing aircraft because too much reliance was placed on a manadatory report from the arriving pilot that his aircraft was over the FAF inbound to the airport. Also, the procedures did not provide for at least a 4-mi. separation between the aircraft.

81. The Boeing Company, Commercial Airplane Group

Study and Concept Formulation of a Fourth-Generation Air Traffic Control System.

Contract DOT-TSC-306 and 145 Report DOT-TSC-306-1 April 1972 5 vols. vol. I, Section 4.4.4. and vol. III, Section 6.2.1. PB-212178--212182

The minimum lateral separation between tracks and longitudinal separation along track which can be maintained is a function of the navigation and surveillance systems performance and the response of the ATC-airplane control loop. An analysis was made of collision risk versus lateral lane separation as a function of surveillance and navigation system performance. The fourth-generation en route surveillance system performance is 300 ft (one sigma) position accuracy with a 1-sec update rate. The lateral navigation position accuracy is 200 to 600 ft (one sigma) en route and 200 ft (one sigma) in the terminal area. Collision risk is low and relatively insensitive in this range of values. Although the required collision risk cannot be specified, the data indicate that a lateral lane of 1.5 nmi is conservatively safe.

82. Bowers, Albert W.

Automated En Route ATC Development Status.

Mitre Corporation, METREK Division Contract DOT-FA70WA-2448 Technical Report MTR-7435, Rev. 1 January 1977 60p.

A brief system description of a digital computer simulation program for automating routine operations of en route air traffic control is presented. The simulation program is currently capable of planning conflict-free flight profiles using altitude clearances and speed clearances. A limited en route metering capability is also employed to derandomize traffic to any TRACON being fed by the simulated en route sector and satisfy an average flow rate as specified by each TRACON. All planned clearances are automatically issued at the proper times to insure that separation standards are not violated.

83. British Pilots Say Air-Control System in U.S. Is Unsafe.

New York Times Monday, April 21, 1975 p. 49

The British Airline Pilots Association says that a new air traffic-control radar system in the U.S. is unsafe and has caused 131 hazardous situations and 11 near collisions in its first month. The FAA denied that there had been reports of any hazardous conditions of near misses attributed to the system.

84. Britt, C.L., Jr., et al

An Investigation of Vehicle Dependent Aspects of Terminal Area ATC Operation.

In: Joint Automatic Control Conference, 13th, Stanford, Cal., August 16-18, 1972, Preprints of Technical Papers. N.Y., AIAA, 1972. p. 488-498

Description of a terminal area simulation which permits analysis and synthesis of current and advanced air traffic management system configurations including ground and airborne instrumentation and new and modified aircraft characteristics. The simulation contains algorithms for conflict detection, conflict resolution, sequencing and pilot-controller data links.

85. Britt, C.L., Jr., et al

Research in Ground-based Near-terminal Area 4D Guidance and Control.

Presented at the International Council of the Aeronautical Sciences, Congress, 10th, Ottawa, Canada, October 3-8, 1976. Paper 76-59 10p.

This paper describes the work being done at NASA, Langley Research Center and at the Research Triangle Institute on advance, ground-based guidance and control for the near terminal area. Large-scale computer traffic simulation in conjunction with flight experiments with a Boeing 737 aircraft will be used to evaluate various concepts for automated terminal area metering and spacing. The all-digital real-time air traffic simulation model is described. Facilities

for aircraft tracking and for interfacing the aircraft with the digital simulation are discussed, along with possible application to other types of experiments.

86. Britt, Charles L., Jr.

An Investigation of Errors and Data Processing Techniques for an RF Multilateration System.

Research Triangle Institute. Report RTI-43U-954 NASA-CR-132 609
February 1975 149p. N75-17327#

The development of an RF Multilateration system to provide accurate position and velocity measurements during the approach and landing phase of Vertical Takeoff Aircraft operation is discussed. The system uses an angle-modulated ranging signal to provide both range and range rate measurements between an aircraft transponder and multiple ground stations. Range and range rate measurements are converted to coordinate measurements and the coordinate and coordinate rate information is transmitted by an integral data link to the aircraft. Data processing techniques are analyzed to show advantages and disadvantages. Error analyses are provided to permit a comparison of the various techniques.

87. Browde, A.

Collision Avoidance System.

In: IFALPA NEWNAV Symposium, Frankfurt am Main, West Germany, October 5-7, 1971, Report. Volume 2, p. III-1-1 to III-1-7. Frankfurt am Main, Vereinigung Cockpit, 1972

Review of the development, design, operation, and performance of the MDC time frequency cooperative midair collision avoidance system. The effectiveness of the system is discussed.

88. Browde, Antole

Statement of the Vice President, CNI Programs, McDonnell Douglas Corp.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 126-140

Discusses the progress of the aviation industry in the field of collision avoidance and comments on Senate bill S.2264.

89. Browde, Anatole and Watson, F.D.

Application of the Time/Frequency Collision Avoidance System as an Aid for Landing and Ground Obstacle Avoidance.

McDonnell-Douglas Co. 1971 15p. N72-28672

The analysis and design effort that produced the threat evaluation and escape maneuver logic of the collision avoidance system (CAS) for the air-to-air situation has produced two new applications in the field of air safety: for the avoidance of ground obstacles, and for the provision of a minimum altitude protection zone around airports. It is determined that the airborne CAS with only minor adaptations, can provide this additional protection. Installation of a CAS compatible time/frequency ground beacon on or near the obstacle or at an airport automatically provides inputs to the airborne CAS for threat evaluation and clear escape maneuver commands. As an option, this beacon can also be used for aircraft resynchronization. The addition of these functions in no way compromises the normal air-to-air CAS protection. The aircraft threat relative to all CAS-equipped aircraft and relative to ground beacons is evaluated once every three seconds as before.

90. Brown, D.O.

DSF/GAT-IIA Test of IPC Performance.

FAA, NAFEC Project no. 034-242-010 Letter Report NA-11-75-LR May 1975 4p.

The objective of this activity was to conduct a preliminary investigation of the interaction between Intermittent Positive Control (IPC) and the Air Traffic Control (ATC) system in a terminal area environment utilizing the Digital Simulation Facility (DSF) and the GAT-IIA flight simulator.

91. Buchanan, W.E. and Kiley, E.F.

Integrated, Universal Pilot Warning/Collision Avoidance Display.

In: Society for Information Display, International Symposium and Exhibition, San Diego, Calif., May 21-23, 1974, Digest of Technical Papers. New York, Lewis Winner, 1974 p. 148, 149

The state of the art in the development and implementation of an integrated ground-based and air-to-air pilot warning indicator/collision avoidance system is discussed. The display technology already available includes multicolored alphanumeric components and off-the-shelf drivers. The four means used for 3-D position sensing and the hardware of the system are reviewed briefly.

92. Buck, R.M.

Controller Alerting Safety Features In An Automated ATC Environment.

In: EASCON '75; Electronics and Aerospace Systems Convention, Washington, D.C., September 29--October 1, 1975, Record. N.Y., IEEE, 1975. p. 116A--116H.

Two of the safety oriented functions in the UTG (Upgraded Third Generation) ATC automation effort are treated. The first function alerts the controller when aircraft are predicted to violate minimum separation standards, while the second alerts the controller when Mode-C-equipped aircraft are predicted to violate a minimum safe altitude. These latter aircraft transmit their altitudes by means of an ATC radar beacon system transponder. History, current status and future plans for these functions as they apply to both en route and terminal areas are briefly described.

93. Buck, Robert M.

We've Waited Long Enough. The Time Has Come.

Air Facts vol. 36, no. 1, p.15-16, January 1973

A CAS system should be a top priority job, a group locked in a room until we get it done -- and not an FAA committee, but an impartial one.

94. Bulford, Dorothy E.

Collision Avoidance: An Annotated Bibliography, September 1968 -- April 1972.

FAA, NAFEC Report NA 72 - 41 August 1972 262p. AD 746 863 N72-29672

A bibiliography of 828 annotated references. It supplements a November 1968 listing of 1013 references, issued as NA68-54 (AD 677 942).

95. Burgess, George D.

Midair!!

MAC Flyer vol. 20, p.16-18, November 1973

96. Busch, Allen C. and Bradbury, Paul

Measurement & Analyses of ASR-4 System Error.

FAA, NAFEC Project No. 142-177-010 Report RD73-62 3 vols.
Vol. I: Overview. (FAA-NA74-55) November 1974 22p. AD-A002 748
Vol. II: Analyses. (FAA-NA72-87) August 1973 152p. N73-30650
Vol. III: Summary. (FAA-NA74-8) December 1974 73p. AD-A004 309

The positional accuracy of aircraft radar targets as displayed in an air traffic control airport surveillance radar system (ASR-4) was sought as one of the inputs essential for determining aircraft separation standards. Using radar track input from the Atlantic City, New Jersey, ASR-4, the radar targets of two test aircraft executing flight patterns of varying relative spacing were photographed as displayed in both beacon and primary radar modes on scan-converted and PPI displays. The displayed positions were related to simultaneous precision track from single-target instrumentation radars (EAIR and TAIR) to derive error measures for range, azimuth, and separation. The extensive analysis program employed a "least-squares" analysis of variance. The data clearly demonstrated the strong interdependence of the individual components that contribute to radar system separation error. Further, it was noted that the tails of the distribution of the radar separation error response measure were not normally distributed.

97. Busch, Allen C., Colamosca, Brian and Van der Veer, John R.

Collision Risk and Economic Benefit Analysis of Composite Separation for the Central East Pacific Track System.

FAA, NAFEC Project No. 012-102-230 Report EM 77-5 (NA 77-32)
June 1977 141p.

This report presents an evaluation of the application of composite separation to the Central East Pacific track system. Criteria for the evaluation were a collision risk and an economic benefits comparison of the existing four-route and proposed composite six-route systems. Lateral, longitudinal and composite collision risks were estimated for the existing and proposed composite systems based upon the accepted North Atlantic Systems Planning Group methodology, while vertical collision risk was calculated based upon NAT/SPG studies. Lateral collision risk for the proposed composite system was found to be lower than for the existing structure. Comparisons of fuel burn and flight times indicated the proposed composite system would be more economically beneficial than the existing route configuration.

98. Buxbaum, P.J.

Tracking of DABS-equipped Aircraft.

IEEE Trans. vol. AES-8 p. 298-305 May 1972

Investigation of the potential value of turn-rate telemetry in the tracking of aircraft equipped with the discrete address beacon system (DABS) that is to replace the present air traffic control beacon system as the prime sensing tool for air traffic control in the 1980's. The design of DABS tracking algorithms is discussed, and the results obtained with a tracker simulation using a Kalman filter

algorithm are shown to indicate that including turn-rate telemetry of moderate accuracy considerably improves tracking of DABS-equipped aircraft. It is found that steady-state improvements of the order of 10 to 1 are obtained over a broad range of flight geometries.

99. CAA Reports On Airmisses.

CAA Paper 75001: An Analysis of the Civil Airmiss Situation in the United Kingdom and Its Relation to Collision Risk. Cheltenham, Glos., England, (1974?)

Condensed in: Flight International vol. 107, no. 3440, p.226, February 13, 1975

The number of airmisses likely to occur in a given time has been shown theoretically to vary as the square of the traffic. This one main conclusion in a report published by the British Civil Aviation Authority analysing the record of UK civil airmisses over the past few years. It also investigates whether the airmiss record provides an effective measure of the safety of the air traffic control system.

100. CAS: Answers But No Solutions.

Astronautics & Aeronautics vol. 10, no. 6, p. 12-13, June 1972;
no. 7, p. 12-13, July 1972

The FAA's position is that the ground-based ATC system remains the primary means of preventing collisions. Nonetheless, it recognized the responsibility to "investigate, evaluate, and implement other techniques for preventing collisions provided that they: (1) enhance over-all system safety; (2) are compatible with the ground-based ATC system; (3) are acceptable to all airspace users; and (4) can be economically attractive to the user." So far, no CAS equipment meets these criteria. The FAA is moving toward the "intermittent positive control" concept. Sometime after 1980, all aircraft would be equipped with a discrete-address beacon system (DABS) and a cockpit display.

101. Caldara, Joseph D.

ATC and CAS -- Compatible or Competitive?

Airport World vol. 5, no. 11, p. 38 November 1972
Controller vol. 13, no. 1, p. 22, February 1974

There can never be a truly effective midair collision avoidance system all ground based or all airborne. ATC and CAS, not only compatible but closely co-operative, can prevent what everyone in aviation fears the most -- a catastrophic midair collision!

102. Canadian Delegation

Effects of INS on NAT Longitudinal Separation Using Mach Techniques.

ICAO NAT/SPG9-WP/2 May 1973

This paper presents the results of a survey of the longitudinal separation maintained between 1116 pairs of aircraft which operated through the Gander/Shanwick Oceanic Control Area during August of 1971. In addition, a comparison of the maintenance of longitudinal separation between B747 type aircraft and between aircraft other than that type is shown. This comparison is intended to provide some measure of the effect of Inertial Navigation Systems on longitudinal separation.

103. Carlson, Neal A. et al

PWI Test and Developmental Resource Utilization.

Intermetrics, Incorporated Final Report No. DOT-TSC-188-1
November 15, 1971 228p.

The primary objectives of the study was to assess the utility of existing test facilities and evaluation tools, and to identify the need for modifications or additions to these. The major physical characteristics of the Fecker and Loral PWI systems are described, and an analytic model presented for the incident radiant power received by the PWI device, including atmospheric transmission effects. The CASTE digital computer program for simulating PWI performance in selected air traffic environments is evaluated and modifications suggested.

104. Case, B., Browder, J. and Hall, J.

SECANT VECAS Flight Test and Evaluation Equipment.

RCA Electromagnetic and Aviation Systems Division Report no. TP2133
June 1973 126p. AD 787 032

The development undertaken was the interface circuits and equipment to permit the information in the SECANT system to be recorded in digital form for automatic processing. Two VECAS systems were fabricated, assembled, and tested. Two sets of special test equipment consisting of a Calibration Generator and a Traffic Simulator were fabricated, assembled, and tested.

105. Castelbou, C.

Air Traffic Control and the Prevention of Collisions.

Navigation (Paris) vol. 21, p. 355-365, July 1973. (In French)

In controlled air spaces, air traffic control is responsible for collision avoidance under instrument weather conditions by maintenance of adequate separation. In visual weather conditions, it is only responsible for maintenance of separations. The obligatory IFR airspace, the controlled airspace where VFR flights are monitored by ATC, mixed civil-military airspaces, and the controlled airspace without particular rules of admission are considered. Attention is given to high density, positive control, mixed, and uncontrolled airspaces. Pilot-controller liaison, aircraft control center liaison, and inter-sector and interregion control coordination are treated.

106. Chavkin, Jerold M. and Kay, Marvin E.

Safety-Related Engineering and Development Activities of the Federal Aviation Administration.

Mitre Corporation Contract DOT-FA70WA-2448 Report FAA-EM75-2 (M75-24)
March 1975 112p. AD-A008 395 N75-24698

The FAA's engineering and development (E&D) program directly related to the goal of improving air safety is defined. Those safety-related E&D activities are categorized to correspond with associated categories of aviation accidents/fatalities for the period January 1964 to December 1972 are presented for each category. A summary description of each safety-related E&D activity is presented including the safety-related goals, current status, and future plans. Funding, by category, is presented for FY72-FY75.

107. Cheaper LSI May Affect Views on Avoidance Gear.

Electronics vol. 47, no. 15, p. 29-30, July 25, 1974.

ARINC Research Corp., Annapolis, Md. was awarded a contract for $116,000 for a six-month study of systems containing LSI.

108. Chevaleraud, J.P., Santucci, G. and Goucaud, G.

Results of an Inquiry Concerning the Exterior Lights of Aircraft.

Revue de Medecine Aeronautique et Spatiale vol. 13, p. 204-207,
3rd Quarter 1974. In French

Summarizes the results of a questionnaire distributed to 146 civil and military pilots which sought their opinion regarding the use, effectiveness, and possible improvement of present systems of position and anticollision lights. Two-thirds of the pilots expressed the desire to have the intensity of anti-collision lights increased. Fifty-six pilots were in favor of

having red anticollision lights, fifty-five wanted white, and nineteen wanted a combination of red and white. Seventy-three pilots put the optimal flash frequency for flashing lights between 60 and 120 flashes per second. Seventy-eight pilots believed that the position lights gave a satisfactory indication during flight, while sixty-six were of the opposite opinion. (IAA)

109. The Civil/Military Controversy.

Business and Commercial Aviation vol. 37, no. 2, p. 10, 13-14, August 1975

Letters objecting to editor Archie Trammell article of May 1975. He replies with the fact that it is upsetting to have a near-miss with a pea-brained civil pilot, but, when a pilot whose training, airplane, salary and operational costs are all paid for by the tax dollars makes a pass on the tax-payer himself, it's infuriating.

110. Clark, J. and McFarland, A.

Initial Collision Avoidance Algorithms for Beacon-based Collision Avoidance System.

Mitre Corporation Contract DOT-FA69NS-162 FAA Report RD 77-163 (MTR-7532) April 1977 99p.

This document describes a set of baseline collision avoidance alogrithms which can be used as a point of departure for the development of final algorithms for the FAA's Beacon-based Collision Avoidance System (BCAS). The algorithms were structured to permit great flexibility in an experimental environment such as NAFEC. They incorporate a number of selectable options in the collision avoidance logic and in the display output.

111. Clark, James S.

Active Beacon Collision Avoidance System Computer Algorithms -- ATCRBS Mode.

Mitre Corporation. Contract DOT-FA70WA-2448 Technical Report MTR-7280 August 1976 63p.

This document describes the functional modules in the active Beacon Collision Avoidance System (BCAS) ATCRBS mode logic in sufficient detail to permit other organizations to analyse or to program a system functionally equivalent to that flown in a test-bed experiment during 1975 and 1976.

112. A Cleanup of an NBC Demagogic Documentary.

Congressional Record vol. 123, no. 188, p. H12504 -- H12510, November 29, 1977

Dale Milford, Chairman, Subcommittee on Transportation, Aviation and Weather, presents the FAA rebuttal to NBC Segment 3 Broadcast of November 2,3,4, 1977. Mr. Milford calls the documentaries demagogic criticisms of the FAA backed by out-of-context quotes from various air safety experts. He says, "Gross amounts of factual information were totally ignored by the authors of the so-called documentaries." Statements 6 and 12 were related to midair collisions.

113. Cockpit Traffic Displays Studied.

Aviation Week & Space Technology vol. 107, no. 11, p. 25, September 12, 1977

FAA officials said the agency has several efforts under way to study alternative separation concepts and to examine systematically various methods of control in the air traffic field. In Fiscal 1978 the agency will be conducting an effort called "alternative separation concepts" to address the question of what is the right balance between functions performed on the ground and functions performed in the aircraft.

114. Cohen, Maurice and Richardson, Charles

Beacon Collision Avoidance System (BCAS) -- Active Mode.

FAA, NAFEC Project No. 052-241-200 Report RD 77-98 (NA 77-11) October 1977 35p.

This document describes the FAA/Mitre Active Mode of the Beacon Collision Avoidance Systme (BCAS) through its initial phase. The hardware, its procurement and modification are described; the theory of operation is presented; and the system performance accuracy during the feasibility flight tests in the NAFEC and Washington, D.C. airspace are discussed.

115. Cohen, Saul and Horowitz, Barry M.

Airborne Collision Avoidance System Concepts Logic Applied to the 1982 Los Angeles Basin Standard Traffic Model.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6677 July 1975 61p.

This report presents estimates on the number and types of commands which pilots would receive if their aircraft were equipped with Airborne Collision Avoidance Systems (ACAS) in the 1982 Los Angeles basin traffic environment. In addition, a comparison is made between the number and types of command generated by ACAS with commands that would be generated by a ground-based collision system called Intermittent Positive Control (IPC) in the same Los Angeles basin environment.

116. Coleman, H. Paris and Bishop, Walton B.

Collision Avoidance and Station Keeping Antenna System.

U.S. Patent 3,851,334 November 26, 1974 5p.

The patent describes a method of applying a circularly symmetric antenna system to collision avoidance and station keeping with the ability to respond retrodirectively. Specifically, airborne or surface vehicles may employ a method which determines the relative bearing between the vehicles from a single interrogation of one vehicle by the other.

117. Collins, J.H. and Grant, P.M.

The Role of Surface Acoustic Wave Technology in Communication Systems.

Ultrasonics vol. 10, p. 59-71, March 1972 23 refs.

A survey is presented of the principles, parameter values, and classes of the analog matched filters (AMF's) and their tradeoffs with digital matched filters when viewed in the context of future systems in M-ary, frequency hopped, and direct sequence spread spectrum modems, a continuous multiple access communication system, navigation systems, a time-division multiple access air-traffic control system and, finally, in a high traffic density, large spatial volume, aircraft collision avoidance system. IAA

118. Collins, Richard L.

Collision Insurance; an Editorial.

Flying vol. 101, no. 2, p. 44, August 1977

After witnessing what the author considers a system-induced midair-collision hazard with three examples he experienced, he recommends the following insurance. Lower the floor of positive-control airspace in the Washington-Boston corridor from 18,000 to 12,500 feet and limit everybody to 250 knots below that altitude. This would keep the jets at or above 12,500 for cruising and leave plenty of airspace for most VFR operations.

119. Collins, Richard L.

Flying Safely. (New York), Delacorte Press/Eleanor Friede, 1977. 276p. Chapter 7 is devoted to Midair Collisions, p. 115--129.

120. Collins, Richard L.

On Top -- FAA and "Separation Assurance".

Flying vol. 100 no. 1, p. 14, 95, 98, January 1977

Reviews the collision avoidance and traffic control plan of FAA.

121. Collins, Richard L.

On Top -- Midair Collisions.

Flying vol. 98, no. 2, p. 18--20, February 1976

Emphasizes the need for "see-and avoid" on the part of general aviation pilots.

122. Collins, Richard L.

The Price of Collision Avoidance.

Flying vol. 96, no. 2, p. 20--22, February 1975

Reviews paper by David D. Thomas on VFR control towers and collisions. Thomas said to "Emphasize traffic-pattern discipline and 'see-and-avoid' principles in all training and educational programs. Establish discrete frequencies at all general-aviation airports with 50,000 or more annual operations to permit better use of 'self announce' entry into traffic patterns. Establish general-aviation automatic terminal information service in metropolitan areas for more informed adherence to desired traffic flows."

123. Collision-Avoidance.

Combat Crew vol. 23, p. 8-9, October 1973.

124. Collision Avoidance: An Accounting.

AOPA Pilot vol. 18, p. 94-95, January 1975

General Accounting Office has now taken thorough look at FAA's search for a collision avoidance system. GAO recommended that the agency should thoroughly evaluate all possible solutions, both ground based and airborne. FAA must "validate its approach through a comprehensive analysis" of costs and capability of all such systems.

125. Collision Avoidance and Rendezvous Navigation.

Journal of Navigation vol. 26, no. 4, p. 497-510, October 1973

A Conference organized jointly by the Institutes of Navigation in Europe (France, Italy, Germany and the United Kingdom) and the United States was held in Hanover from 2--5 October 1973. The theme of the meeting was Collision Avoidance and Rendezvous Navigation. A summary of the papers presented is in this issue and a selection will be printed in following numbers of this Journal.

126. Collision Avoidance and Rendezvous Navigation: Proceedings of the International Congress, Hanover, Germany, October 2-5 1973. Congress sponsored by the European and American Institutes of Navigation. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. 2 vols.

Collisions at sea seem to be of major interest to the Congress, but there are papers related to aviation.

127. Collision-Avoidance Injuries Blamed on Radar Controller.

Flight Operations vol. 65, no. 9, p. 36-38, 45, August 1976

Excerpts from NTSB report of accident on November 26, 1975 between an American Airlines Douglas DC-10 and a Trans World Airlines Lockheed L-1011 when they almost collided head-on at 35,000 feet near Carleton, Michigan. The probable cause of this near-collision was the failure of the radar controller to apply prescribed separation criteria when he first became aware of a potential traffic conflict, which nessitated an abrupt collision avoidance maneuver.

128. Collision Avoidance On the Line. (Aircraft and Vehicles).

Interceptor vol. 16, p. 5-8 January 1974

129. Collision Avoidance Procrastination Continues.

Interavia vol. 27, no. 9, p. 1005, September 1972

Reviews the developments in CAS and predicts that it will be unlikely that a final decision will be made within the next two years toward adoption of a system.

130. Collision-Avoidance Selection by FAA Surprises Industry.

Electronics vol. 48, no. 22, p. 29, October 30, 1975.

The ground-based B-CAS system makes use of the altitude-encoding transponders to be found on board all commercial aircraft and some general aviation aircraft. Designed by consultant George Litchford, it will be built by Megadata Computer and Communications Corp., Bohemia, N.Y.

131. Collision Avoidance Systems Controversy.

Interavia vol. 27, no. 5, p. 472, May 1972

The early implementation of an effective CAS is of major concern to the airlines, but they are waiting for the FAA to establish a national equipment standard.

132. Collision Avoidance Systems Range From $2,500 to $60,000, FAA Says.

Aviation Daily vol. 207, no. 28, p. 220, June 8, 1973

Installation of anticollision systems aboard commercial airliners could cost as much as $120,000 per aircraft, FAA has told a House appropriations transportation subcommittee. Even the lowest cost available would put a $2,500 price tag on general aviation aircraft.

133. Collision Laid to F-111 Rendezvous Error.

Aviation Week & Space Technology vol. 103, no. 12, p. 21-22, September 22 1975

NTSB ruled an Air Force pilot's mistaking a light turboprop aircraft for a Boeing KC-135 tanker with which he was to rendezvous as the probable cause of the midair collision that killed a corporate aircraft pilot near Kingston, Utah, November 12, 1974.

134. Collision Rationale.

AOPA Pilot vol. 15, no. 9, p.7, September 1972

Discussion of the NTSB recommendations to FAA as a result of the midair collision at Raleigh-Durham airport, December 4, 1971.

135. The Collision Risk.

Flight International vol. 112, no. 3571, p. 517, August 20, 1977

Brief review of CAA paper 76041 titled "A Statistical Study of Midair Collisions Involving Public Transport and Executive Jet Aircraft, 1946-1975 World-Wide", by B.W. Belcher and D.M. Penna.

136. Collision Risk Unchanged, Says CAA.

Flight International vol. 111, no. 3547, p. 509, March 5, 1977

Brief notice announcing CAA Paper 76041, which states midair collision risk worldwide has remained virtually constant over the last 30 years, but the number of fatalities in any midair collision has roughly doubled in that time.

137. Collision Threat Cited in Tu-144 Crash.

Aviation Week & Space Technology vol. 100, no. 24, p. 25, June 17, 1974

Final report on the crash of the Tupolev Tu-144 supersonic transport at the 1973 Paris air show was signed and accepted by both French and Soviet authorities. The Soviet/French inquest board did not identify a single certain and specific cause for the crash. Circumstantial evidence gathered in the investigation weighs heavily on the prospect that a collision-avoidance maneuver by the Tu-144 crew was a major factor in the accident.

138. Collision Warning System Tested.

Aviation Week & Space Technology vol. 98, no. 3, p. 66, January 15, 1973

The system, first designed and developed by Mitre, is called "conflict alert". Tests were flown at Jacksonville, Fla., ARTCC with FAA aircraft. The system provides high altitude sector ATC controllers with advance warning of potential imminent conflicts, providing a back-up to planned separation provided by controllers. The system tested used position and altitude data from ATC transponders.

139. Collisions -- an editorial.

Flight International vol. 110, no. 3524, p. 955, September 25, 1976

There have been more than 70 midair airliner collisions in the last 30 years. Of these, the majority, 41, occurred in the USA. Of the others, three were in Canada, 11 in South America, 10 in Europe (of which 2 were in the UK) 7 in Asia and one in Africa. Of the 70-plus total, 16 were airliner-airliner; 17 were with military aircraft; and 40 were with general-aviation aircraft. The last UK collision involving a public-transport aircraft was in 1949, when a BEA Dakota and an RAF Anson collided near Coventry. Believes the old airmanship virtues -- listen out and look out -- are as valid as ever.

140. Communications, ATC Cited in Midair Collision.

Aviation Week & Space Technology vol. 102, no. 13, p. 58, March 31, 1975

The midair collision of an Iberia DC-9 and a Spantax Convair 990 near Nantes, France, March 5, 1973 resulted from a complex sequence of events dominated by poor communications, inadequate radio and radar facilities and confused air traffic procedures, a French commission of inquiry has decided.

141. Computer-Assisted Conflict Resolution In ATC.

CATC Electronics News vol. 15, no. 1, p. 30-32, June 1975

Reviews simulation studies in progress at the Royal Radar Establishment of (1) suitable methods for such intercommunication between controller and computer, (2) methods for monitoring the system to ensure that aircraft maintain conflict-free paths and and (3) the best ways to display and resolve conflicts where airways intersect.

142. Computer Systems Engineering, Inc.

Computer-Aided Metering and Spacing with ARTS-III. Phase II. Design Study.

Contract DOT-FA70WA-2433 Report FAA-RD72-9 July 1972 161p. AD 757 051

Strategies for sequencing aircraft of like speed and weight class in groups rather than in their random order of arrival were found to have little prospective benefit in enhancing average landing rate as feeder fix holding penalties are incurred. Under IFR conditions, capacity benefits will be attained by fixing gate position for all aircraft.

143. Conflict Alert.

AOPA Pilot vol. 19, no. 1, p. 86, 88, January 1976

FAA issued a news release recently which said that whenever the flight paths of any aircraft flying at 18,000 feet or higher are projected to get closer than the required horizontal and vertical minimums, the controller handling those aircraft will be alerted, automatically. The computer knows positively the identity and altitude of each aircraft. Furthermore, it can compute the airspeed of each aircraft.

144. Conflict Alert.

FAA General Aviation News vol. 16, no. 6, p. 6-8, October 1977

"Conflict Alert" is a computer-generated display on the radar scope which provides controllers with early information whenever two radar tracked aircraft are projected to pass dangerously close to each other, 400 feet of altitude separation and less than 1.2 nautical miles of lateral separation. As of the above date it is undergoing a 60 day field test at Houston International Airport.

145. Conflict Alert.

Flight Safety Focus no. 3, p. 14, April 1976

Computers at FAA ARTC Centers are now programmed to scan all traffic every six seconds. When aircraft are projected to get closer than minimum separation standards, their identification tags on the controller's radar scope will flash or blink to alert the controller. In addition, a clear text message will appear on the scope advising the controller of the identification of these aircraft that are in conflict.

146. Connelly, Mark E.

Applications of the Airborne Traffic Situation Display In Air Traffic Control.

In: *Plans and Developments for Air Traffic Systems*. Papers presented at the 20th Symposium of the Guidance and Control Panel, held in Cambridge, Massachusetts, 20-23 May 1975. AGARD Conference Proceedings No. 188. Paper No. 35. 12p.

This paper reviews the results of an extensive series of real-time simulation tests, the purpose of which was to evaluate the potential usefulness of displaying traffic and map information in an aircraft cockpit and the effects that the availability of such information would have on ATC procedures and capacities. These tests indicate that the ATSD is a valuable aid to the pilot in executing the following basic functions: conflict detection and resolution, conforming to airspace structures, precise spacing in trail, merging, sequencing, monitoring runway occupancy, backup procedures after an ATC failure, approach to one of two closely-spaced parallel runways operating independently, and taxiing on the airport surface.

147. Connelly, Mark E.

The Role of the Airborne Traffic Situation Display in Future ATC Systems.

IEEE Trans. on Communications vol. COM-21, no. 5, p. 624-638, May 1973

The author notes that the RNAV/ATSD Combination can provide aircraft with adequate independent collision avoidance protection and, hence, eliminate the need for a separate special-purpose CAS or PWI device on board. CAS is a one-function device. It provides independent protection in relatively rare but important acute conflict cases, but that is all that it does. The ATSD, on the other hand, is useful in both normal and abnormal situations, continously bolstering the pilot's assurance and actively assisting him in precise spacing, merging, monitoring of runway occupancy, and taxi operations on the ground as well as conflict detection and resolution. These additional functions make the ATSD more cost effective than CAS and the logical choice for joint development with RNAV.

148. Connors, Mary M.

Conspicuity of Target Lights: The Influence of Color.

National Aeronautics and Space Administration, Ames Research Center, Report No. NASA-TN-D-7960 November 1975 14p. N76-12727

This study investigated the conspicuity, or attention-getting qualities of foveally-equated, colored lights, when seen against a star background. Results indicate that red targets were missed more frequently and responded to more slowly than lights of other hues. Yellow targets were acquired more slowly than white, green or blue targets; responses to white targets were significantly slower than responses to green or blue targets. In general, flashing lights were superior to steady lights.

149. Connors, Mary M.

Conspicuity of Target Lights: The Influence of Flash Rate and Brightness.

National Aeronautics and Space Administration, Ames Research Center. Report No. NASA-TN-D-7961 September 1975. 17p. N75-31732

The stimulus characteristics of lights that might aid a pilot to see and avoid, by alerting him to a potential threat were studied. The relative conspicuity of foveally equated, point-source, steady and flashing lights of several brightnesses, seen against star/background was examined. The lights appeared at random intervals while the subject was periodically distracted by a simulated cockpit task. The results indicate that correct target detection increases and reaction time decreases with increased target intensity. Steady lights are missed more frequently and acquired more slowly than flashing lights.

150. Control Data Corp.

Air-to-Air Visual Detection Data.

Contract DOT-FA70WA-2263 Interim report FAA-RD-73-40 April 1973
38p. N73-21145

Tests were conducted to determine ability of pilots to visually detect other aircraft in an air-to-air situation. The tests were based on the requirement to detect potentially hazardous intruders in the pilot warning instrument (PWI) concept. It was concluded that there is a high likelihood of seeing the intruder aircraft in sufficient time to take evasive action under visual flight rule conditions if the pilot is given accurate information on the location of the aircraft.

151. Controller Slip Caused Collision.

General Aviation News vol. 24, no. 11, p. 23, May 28, 1973

The fatal April 12th midair collision between a NASA Convair 990 and a Navy P-3C Orion at Moffett Field, Calif., was caused by a controller's slip of the tongue.

152. Cooper, H.W. and Grauling, C.H., Jr.

Production Design and Cost Analysis of an Aircraft Collision Hazard Warning System.

Westinghouse Defense and Electronic Systems Center NASA report no. NASA-CR-132308 June 1973 172p. X73-10561 (Available to U.S. Government Agencies.)

This phase of the program was to conduct a production design and cost analysis for an FM-CW radar system for use in the commercial airways environment to detect potential aircraft collision hazards. The immediate aspect of the program was to provide a design that can be implemented under a second phase of the program to yield several sets of hardware that can then be flown in a flight evaluation and compared to other existing pilot warning indicators of collision hazard warning systems. A longer range objective was to provide cost estimates of the system in quantities of 1,000 to 10,000 per year starting in about the 1980 time period. On the basis of the work done under Phase 1 of the program, it is estimated that the market cost of the Langley system in large production lots for the 1980 time period warrants continuation of the program. (Author)

153. Cotton, Bill

Separation Assurance: An Update.

Business and Commercial Aviation vol. 40, no. 6, p. 70-72, 74, 76, June 1977

Reviews the recent work on CAS. It is necessary to reject the ANTC-117 definition of a collision avoidance system in order to free engineers to develop a CAS that will keep pilot judgment in the loop. BCAS and ACARS, if used with a map display of the traffic situation, can do that job. BCAS is compatible with DABS, so it cannot be considered an interim solution while waiting for DABS/ACARS to be born. ACARS will never work outside of surveillance coverage, and so it is not a total solution to the collision problem.

154. Cotton, W.B.

Navigation Improvements -- To What End.

In: Upgrading the ATC System: Proceedings of the Annual Meeting, Washington, D.C., November 28, 29, 1973. Washington, D.C., Radio Technical Commission for Aeronautics, 1973. 7p.

Details regarding the Upgraded Third Generation ATC system design are discussed, giving particular attention to navigation and VORTAC improvements. The relationship between navigational accuracy and separation criteria is explored together with the stated objectives and requirements for improved accuracy in aircraft navigation, as found in the FAA's planning documents.

155. Cotton, William B.

Formulation of the Air Traffic System as a Management Problem.

IEEE Trans. on Communications vol. COM-21, no. 5, p. 375-382 May 1973

The functioning of the national air traffic management system is postulated using aircraft operating economies and mission flexibility as the primary goals. The management functions of enroute separation, sequencing for landing, and spacing of aircraft are discussed in an environment of near universal area navigation capability and rapid discreet communication.

156. Cotton, William B.

IPC: A Partial Solution.

Air Line Pilot vol. 44, no. 9, p. 20-23, September 1975

IPC is especially interesting as it represents FAA's first step toward providing pilots with information on other aircraft

since it declared the eyeball obsolete. It is not yet a viable collision avoidance solution, but it is at least a step in the right direction. The author.

157. Coulmy, D. and Mollie, P.

Integrated Communication, Navigation, and Identification Systems.

Navigation (Paris) vol. 24, p. 369-379 October 1976

Intergration of all onboard in-flight systems designed for communication, navigation, and identification, rather than further isolated development of each line of equipment serving those functions, is recommended and evaluated. The new SINTAC time-frequency integrated systems allowing an integrated solution and handling of a maximum of functions with minimum equipment shared in common in executing the functions are described. Cluttering of the aircraft (in weight, bulk, and frequency allocations) by existing systems is contrasted to the advantages attainable with partial integration and with SINTAC complete integration options. Navigation, traffic control, collision avoidance, landing, and aircraft-to-aircraft communications functions of the SINTAC system are discussed. A77-11152

158. Craigie, J.H., Morrison, D.D. and Zipper, I.

Air Traffic Control Surveillance Accuracy and Update Rate Study.

TRW Systems Group Contract NAS5-21603 Report NASA-CR-139043
March 1973 198p. N74-30094

The results of an air traffic control surveillance accuracy and update rate study are presented. The objective of the study was to establish quantitative relationships between the surveillance accuracies, update rates, and the communication load associated with the tactical control of aircraft for conflict resolution. The relationships are established for typical types of aircraft, phases of flight and types of airspace. Specific cases are analyzed to determine the surveillance accuracies and update rates required to prevent two aircraft from approaching each other too closely.

159. Crook, Warren G.

Development of Low-Cost Cockpit/Outside Time Sharing Training Equipment.

FAA, NAFEC Project no. 183-721-04X Report RD 72-95 (NA 72-61)
November 1972 20p. AD 753 924 N73 13030

Ten certificated pilots were given time-sharing training using a low-cost visual in-cockpit device. Training sessions in a ground trainer with subsequent flight checks in an airplane showed marked improvement in cockpit/outside visual scanning and piloting proficiency.

160. Crook, Warren G.

Shortcut To Safety?

AOPA Pilot vol. 16, no. 9, p. 66-67, September 1973

A device under FAA evaluation may offer a simplified means of averting in-flight collisions. It's called a turn-and-miss (TAM) indicator.

161. Crosley, J.K.

A New Approach to Aircraft Exterior Lighting.

In: Survival and Flight Equipment Association, Annual Symposium, 10th, Phoenix, Ariz. October 2-5, 1972, Proceedings. p. 51-53
Safe Engineering vol. 3, p. 14-16, 1st Quarter 1973.

Results of in-flight research to determine the most effective means of increasing aircraft visibility in the daytime through the judicious use of exterior-applied paints and tapes. Concurrently, in-flight studies have also been performed to evaluate the use of high intensity lighting as another method of enhancing daytime aircraft conspicuity. These studies have shown that xenon gas-filled discharge tubes are capable of being effective visual stimulators and have led to the design and fabrication of a day/night lighting system for U.S. Army aircraft application. A system of this type is deemed appropriate for installation on civilian as well as other military aircraft, and would significantly aid in the reduction of midair collisions.

162. Crosley, John K.

Light Of My Life.

U.S. Army Aviation Digest vol. 20, no. 3, p. 44-47, March 1974

The light distribution of Aircraft Anticollision Beacon System, High Intensity Light (AABSHIL) is almost three times greater than standard anticollision lights. The research was begun in 1967 by the USAARL, Ft. Rucker, Ala. The new system includes two individual beacons, each beacon having separate day and night modes. The source of light is a xenon gas-filled discharge

tube (so called-strobe). The day mode is a white light with a minimum initial output level of 3500 effective candelas, while the night mode is red with an output of 150 (minimum) to 200 (maximum) effective candelas. Both lights are phased to flash alternately with a combined flash rate of 90 to 110 cycles per minute.

163. Crush, J.F. and Muller, W.G.

Low Cost Air Traffic Control Experiment.

Hazeltine Corporation AFAL Contract No. F33615-71-C-1898 Report AFAL-TR-72-425 February 1973 70p., AD 907 978

This report describes the first phase of an Air Force program to provide for the integration of existing equipments for flight testing and experimental evaluation of a simplified air surveillance, tracking, and collision avoidance system. The results to be derived from the flight tests are intended to demonstrate the feasibility of a Low Cost Air Traffic Control (LCTC) system for airborne vehicles. The technique used in this basic system for air surveillance is based on time difference principles. The position of each aircraft is determined at the master terminal by measuring the relative time difference of an asynchronous, pseudo-noise coded, short-burst transmission, emitted by the aircraft as received at each of three sites. The coded signals are matched filter processed and relayed to the master terminal where the necessary computations are performed. The coded transmission from each aircraft includes a unique identification code as well as air-derived altitude data.

164. Cuchet, E.

Collision Avoidance in the Air -- Current State and Perspectives.

Navigation (Paris) vol. 24, p. 148-156, April 1976 (In French)

After a brief review of figures and statistics concerning air collisions (70 collisions in all categories between 1946 and 1971) and a brief history of anticollision research (emphasizing the work of the FAA and NASA), the paper deals with three airborne systems of collision avoidance. The first system is that developed by McDonnell Douglas and consists of information transfer between aircraft based on the principle of time and frequency synchronization. The onboard time standards (atomic clocks and quartz oscillators) are synchronized with ground station equipment or with equipment aboard other aircraft.

165. Culbertson, Kent T.

Data Reduction and Analysis of TOA and DAZ of Semi-Active BCAS Feasibility Model.

FAA, NAFEC Data Report Project No. 052-141-220 April 1977 8p.

Feasibility flight tests of the Semi-Active BCAS were conducted during October and November 1976 using EAIR and ARTS III as tracking reference systems. Time-of-arrival (TOA) and differential azimuth (DAZ) in terms of their mean and standard errors were measured.

166. Culhane, L.G. and Horowitz, B.M.

Ground-Based Collision Avoidance Systems for Air Traffic.

In: EASCON '74: Electronics and Aerospace Systems Convention, Washington, D.C., October 7-9, 1974, Record. N.Y., IEEE, 1974. p. 264-271
Mitre Corp. Paper M74-75 August 1974 21p.

Two different, but compatible system concepts are discussed. Firstly, for situations involving IFR aircraft, a conflict alert capability will provide the controller with a displayed alert of impending situations of separation being less than minimums. Secondly, an Intermittent Positive Control (IPC) function, utilizing data link and improved surveillance, provides an automated collision avoidance capability for VFR/VFR and VFR/IFR aircraft pairs, and provides an independent backup to the ATC system for IFR aircraft pairs. In addition, IPC includes pilot warning indications (PWI) for informing pilots of the location of proximate aircraft.

167. Culhane, Lawrence G. and Horowitz, Barry

Conflict Alert and Intermittent Positive Control.

In: AGARD Survey of Modern Air Traffic Control. AGARDograph 209 vol. I, p. 239-256 July 1975 N75-32047

This paper presents analytical, simulation and experimental results which have been obtained in the process of designing and progressing toward the implementation of ground-based collision avoidance systems for air traffic control. Selective subsystem performance criteria established as part of the design process are also presented. Two different, but compatible system concepts are discussed. Firstly, for situations involving IFR aircraft, a conflict alert capability will provide the controller with a displayed alert of impending situations of separtion being less than minimums. Secondly, an Intermittent Positive Control (IPC) function, utilizing data link and improved surveillance, provides an automated collision avoidance capability for VFR/VFR and VFR/IFR aircraft pairs, and provides an independent backup to the ATC system for IFR aircraft pairs. In addition, IPC includes pilot warning indications (PWI) for informing pilots of the location of proximate aircraft.

168. Curry, Renwick E. et al, inventors (to NASA)

Display Research Collision Warning System.

U.S. Patent 3,699,511 October 17, 1972 6p. N73-13643

A head-up display for a PWI system is discussed. The display consists of strips of an electroluminescent tape secured above and below the windshield and above side windows of a cockpit. The strips are associated with elevation range and azimuth range sectors which are viewable by the pilot through the windshield or windows and are located in the directions of these sectors. When a target is detected in any of the sectors by a corresponding detector the strip or strips associated with the particular sector are illuminated. The pilot's peripheral vision is sufficient to notice their illumination thereby enabling him to directly view the particular sector without reference to a display on the instrument panel. Official Gazette.

169. Curtis, O.P. and Rucker, R.A.

Investment Costs for CAS Alternatives (A Preliminary Analysis).

Mitre Corporation Contract DOT-FA70WA-2448 Interim Report EM 74-18 (MTR-6812) December 1974 AD-A005 873 N75-18211

This interim report provides a preliminary analysis of the investment costs which might result from a decision, legislative or regulatory, to implement a nationwide automatic collision avoidance system (CAS), either airborne or ground-based, but physically independent of manned ATC facilities. It estimates basic investment costs totally $602M for an airborne CAS meeting the provisions of Senate Bill 1610 and $471M for a ground-based automatic collision avoidance system (DABS-IPC), excluding the highly variable costs for encoding altimeters which are required by both systems and excluding the costs of avionics already required for other reasons, such as ATCRBS transponders in certain airspaces.

170. DABS Antenna Readied for FAA Testing.

Aviation Week vol. 96, no. 24, p. 38-39, June 12, 1972

Prototype of an electronically scanned radar beacon antenna that will form the cornerstone of the planned discrete-address beacon system (DABS) is now scheduled for delivery late 1972 to NAFEC. E-scan antenna is being built by Hazeltine Corp. It will permit selective and more frequent interrogation of close-in aircraft as well as those aircraft involved in a potential collision threat.

171. Data Runs Intended to Compile Subjective Reactions of General Aviation Pilots to Beacon-based Collision Avoidance System (BCAS) Displays.

Aviation Week & Space Technology vol. 107, no. 11, p. 67, September 12, 1977

12 pilots are flying simulated flights to determine pilot preference in displays. A second phase, to begin near the end of the year, will simulate a complete air traffic control terminal environment with heavy traffic.

172. Dausin, Lawrence R.

A Review and Analysis of the Honeywell Collision Avoidance System--Phase II.

Institute for Defense Analyses Contract DOT-FA74WA-3498 Study S460 FAA Report RD 75-151 October 1975 146p. AD-A021 735 N76-23243

This report explores critical problems of the Honeywell CAS in a high density environment such as that projected by the FAA in 1971 for the Los Angeles Basin in 1982 (800 aircraft). The results of the analysis of detection and false warning probabilities indicate that AVOIDS I and modified AVOIDS-II will function satisfactorily.

173. Dausin, Lawrence R. and Bagnall, James J. Jr.

A Review and Analysis of the McDonnell Douglas Collision Avoidance System. Phase I.

Institute for Defense Analyses IDA Study-S-415 FAA Report RD 73-143 February 1976 66p. AD-A021 678 N76-23246

The analysis shows that the present procedures and equipment design will allow a large number of multiple slot occupancies to occur. Several ways to eliminate the major cause of multiple slot occupancy are mentioned. The analysis of tau alarm accuracy revealed that at low closing rates an excessive delay in a tau alarm may occur if the equipment performs in accordance with the ATA specifications. Because most of the delay arises from correlated errors in range and range rate measurements, the occurrence can persist for several epochs.

174. Decker, Douglas A.

Statement of the Commissioner, Utah Aeronautics Board, Salt Lake City, Utah.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator System. Hearing. 92nd

Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 145-147

Briefly speaks on the general aviation outlook and suggests that military planes fly IFR in high density areas.

175. Dellon, F.

Navigation Performance Requirements for Reducing Route Centerline Spacing.

Mitre Corporation Contract DOT/FA70WA-2448 Working Paper WP-10599 June 5, 1974 46p.

Several different studies have looked into the question of what can be done in the ATC system to enable the current route centerline spacing standard to be safely reduced. These studies include that of Boeing, The Royal Aircraft Establishment (RAE), Autonetics and Mitre. This report summarizes these four approaches to the problem of reducing route centerline spacing and compares the results derived from each.

176. Description of a Model for Assessing the Collision Risk in Dual Airways.

ICAO Second Meeting of the General Concept of Separation (RGCSP Panel) WP/24 October 1973 14p.

This paper gives a description of the model used for assessing the lateral collision risk in dual airways. The model does not give a full analysis of the collision risk in dual airways. It only applies to the collision risk due to loss of lateral separation between aircraft nominally flying on different tracks of the dual airway system. Other possibilities for collisions due to loss of longitudinal separation and loss of vertical separation and collisions with aircraft crossing the track system are not calculated.

177. Dexter, R.G.

AVOID-I Collision Avoidance System (M).

Honeywell, Inc. Contract DOT FA73WAI-358 1974 185p. AD/A-002 492 N75-33019

A detailed description of the work performed on the AVOID-I collision avoidance system is provided. The AVOID-I receiver/transponder, traffic simulator and digital display interface units operation and hardware descriptions are provided in detail. Test procedures developed for the system and test results are included. The system has been delivered to NADC for flight test purposes.

178. Diamond, P.M.

The Potential of a System of Satellites as a Part of an Air Traffic Control System.

In: AGARD CP-105 Air Traffic Control Systems. Papers presented at the 14th Meeting of the Guidance and Control Panel of AGARD held in Edinburgh, Scotland, 26-29 June 1972. Paper 20-1 to 20-17.

The ATC performance potential of satellite systems utilized in a data acquisition and communications role within a continental U.S. (CONUS) ATC system is discussed. The unique properties of satellite-based relays provide the only viable means of achieving complete coverage to ground level of the entire airspace, coupled with uniform and highly accurate surveillance position fixing. Position determination identification, flow control, and collision avoidance functions can be implemented through the use of regional centralization of ground computation, resulting in important benefits to the utilization of the airspace and adaptability of the ATC system. It is shown that the concept of intermittent positive control (IPC) requires aircraft speed/acceleration restrictions and leads to the requirement for surveillance accuracies of 100 to 200 ft. within the densely populated regions of airspace expected in the 1980's.

179. Dietzler, B.G.

Knoxville Associative Processor Evaluation Report.

Sperry Rand Corp., UNIVAC Div. Contract DOT-FA70WA-2289 FAA Report RD73-17 (PX 6406, Revision A) October 1972 324p. AD 757 477 N73-19642

This document contains an evaluation of the Goodyear Aerospace Associative Processor in performance of the tracking and conflict detection functions in a real-time ATC environment. The AP evaluation effort was performed at Knoxville, Tennessee, with Univac as the prime contractor to the FAA and with Goodyear Aerospace and Lambda as subcontractors to Univac.

180. Diringshofen, H. von

The Importance of the So-Called "Human Factor" for the Reliability of Collision Prevention in the Terminal Area.

The Controller vol. 11, no. 1-4, p. 5-6, December 1972

A reprint of an article which appeared in the Winter 1961/62 issue. The pilot should evade other aircraft and air traffic control should provide the necessary safety separation in the airspace under control.

181. Ditmore, M.A. and Rucker, R.A.

TCA/ERS Stage III Costs Study.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM 76-7 (MTR-7266) July 1976 61p. AD-A029 075 N77-20070

FAA report EM-74-15 showed that Terminal Control Areas (TCAs) and Expanded Radar Services (ERS), Stage III, should be very effective in reducting midair collision risks in the busier terminal areas, by converting VFR flights unknown to ATC into known participants in the traffic control process. This study examines the extent to which VFR flights have participated and the costs of providing these services.

182. Downs, H.R.

Aircraft Conflict Detection In an Associative Processor.

National Computer Conference & Exposition, Proceedings, June 4-8, 1973, New York, N.Y. vol. 42, p. 177-180

This paper presents some approaches to organizing the conflict detection algorithm for Air Traffic Control on an associative array processor. The relative efficiencies of these approaches were described and some of the implementation problems were explored.

183. Downtrend in Aviation Accidents Spurs Caution on 1977 Outlook.

Aviation Week & Space Technology vol. 106, no. 3, p. 28, January 17, 1977

U.S. civil aviation continued a downward trend in accident rates during 1976, but near collisions have continued to be of concern to aviation safety officials. NASA's aviation safety reporting system received 1,497 reports for the period July 15 and ending October 14, 1976. During that time, one-third of all reports received involved less-than-standard separation between two or more aircraft.

184. Dreyfuss, D.J. et al

Cost Comparisons of Advanced Air Traffic Management Systems.

Rand Corp. Contract DOT-TSC-344 R-1319-DOT July 1973 162p. N74-11436

A study of the cost of the Advanced Air Traffic Management Systems for operational use in the latter portion of this century was

conducted. The results consist of a cost evaluation of several alternative concepts of air traffic control that differ in the basing of the signal receiver (space or ground), the date of initial operational capability, the level of automation, the structure (centralized or disbursed), and the total system cost. The computer program for conducting the cost estimate comparisons is included.

185. Drouilhet, P.R.

DABS -- Projected Performance and Experimental Results.

In: EASCON '74: Electronics and Aerospace Systems Convention, Washington, D.C., October 7-9, 1974, Record. N.Y., IEEE, 1974. p. 257-263

The central design objectives of the Discrete Address Beacon System (DABS) include the provision of reliable surveillance and data-link communication for all aircraft and a support of automated ATC, including intermittent positive control (IPC), in the projected 1995 traffic environment. The improved surveillance capability of DABS is to be achieved by adding a discrete address mode as an evolutionary enhancement of the air traffic control radar beacon system.

186. Drouilhet, P.R.

DABS: A System Description.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72WAI-261 FAA Report RD 74-189 (ATC-42) November 1974 97p.
AD-A005 056 N75-18208

The Discrete Address Beacon System (DABS), a cooperative surveillance and communication system for air traffic control, is described. Ground-based sensors (interrogators) and airborne transponders are employed. Ground-to-air and air-to-ground data link communications are accomodated integrally with the surveillance in interrogations and replies. DABS is designed as an evolutionary replacement for the current Air Traffic Control Radar Beacon System (ATCRBS) to provide the enhanced surveillance and communication capability required for air traffic control in the 1980's and 1990's. Compatibility with ATCRBS is emphasized to permit an extended, economical transition.

187. Drouilhet, Paul R. and Wells, Walter I.

U.S. Developing Two Concepts for Improved ATC Surveillance, Air/Ground Communications and Collision Avoidance. Part I -- DABS: A Discrete Address Beacon System.

ICAO Bulletin vol. 31, no. 3, p. 13-17, March 1976
AEEC Letter N76-106/AXX-00 October 11, 1976

Paper was presented at the AEEC Avionics Engineering Seminar on "Beacon Based Separation Assurance Systems", Munich, Germany, September 3, 1976. Looking ahead to needs of the 1995 projected air-traffic environment, DABS involves a data link that is a significant extension of today's secondary surveillance radar scheme.

188. Duncan, Thomas W., Sample, Steven B. and Scheuer, Paul R.

A Low-Cost Directional Pilot Warning Instrument.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems Hearing. 92nd Congress. Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO 1972. p. 163-167.

Attachment to statement by Steven Sample in which they describe their instrument.

189. Duning, K.E. et al

Curved Approach Path Study.

Collins Radio Company, Avionics Division Contract FA72WA-2824 FAA Report RD 72-143 March 15, 1973 127p. AD 763 603

The application of Microwave Landing System to provide increased operational flexibility and improved capacity in the terminal area is discussed in this report. Terminal area operational concepts and flight path families for use in the MLS environment are developed, and examples of special noise abatement paths are discussed. A model for developing safe separation standards for aircraft which are on roughly parallel paths was produced.

190. Dunlay, William J., Horonjeff, Robert and Kanafani, Adib

Models for Estimating the Number of Conflicts Perceived by Air Traffic Controllers.

California University, Institute of Transportation and Traffic Engineering, Contract DOT-FA72WA-2827 December 1973 150p. AD-A-023 533

This research seeks to define and estimate the frequency of aircraft interactions (called conflicts) which entail controller intervention. The task of conflict detection is viewed as a stimulus-response process in which the strength of stimulation is a particular closest-approach separation between aircraft, and the corresponding probability of response is the fraction of times controllers judge that separation to be a potential violation of the 5 nautical mile minimum separation standard.

Data from human factors studies of air traffic control are used to estimate response probabilities for a wide range of closest-approach separations. Two empirical models are derived for estimating the number of conflicts.

191. Dunlay, William J., Jr.

A Stochastic Model of Controlled Airway Traffic.

Federal Aviation Administration, Office of Aviation Policy and Plans Report AV 71-6 September 1972 50p.

The purpose of this paper is to describe a method for estimating the expected number of aircraft interactions that require controller intervention for a given sector and set of traffic conditions. The desired result is the total number of overtake, crossing, and merging conflicts, where a "conflict" is defined as the violation of some specified separation standard which would occur if the controller did not issue appropriate avoidance instructions.

192. Eastwood, J.H.

Advanced SSR Techniques Can Help Avoid Midair Collisions.

ICAO Bulletin vol. 27, no. 11, p. 21-23, November 1972

The introduction of selective aircraft interrogation to the secondary surveillance radar link plus faster, more accurate bearing data could enhance safety and reduce air traffic controller workload.

193. Ebert, Paul M.

Beacon Collision Avoidance System (B-CAS). Test Plan.

Mitre Corporation Contract DOT-FA70WA-2448 Project No. 052-241-100 Technical Report MTR-7092 November 1975 38p.

This paper describes the test procedure, data collection and data reduction for the Beacon Based Collision Avoidance System test flights. Also included are the flight plans needed to determine how well BCAS will function as a collision avoidance system.

194. Edwards, Gerald D. and Harris, James L., Sr.

Visual Aspects of Air Collision Avoidance: Computer Studies on Pilot Warning Indicator Specifications.

Scripps Institution of Oceanography Report No. SIO-Ref-72-3 NASA-CR-126669 February 1972 28p. N72-24672

Techniques of computer calculations used to analyze the potential for improving visual acquisition of collision threats by means of Pilot Warning Indicator systems (PWI) are described. The quantitative effects of PWI resolution and effective range upon the average cumulative probability of detection are presented.

195. Eldredge, Donald, Crook, Warren and Rich, Paul

Simulation of Original and NAFEC Proposed Intermittent Positive Control Cockpit Display.

FAA, NAFEC Project No. 052-241-200 Report RD 77-73 (NA 77-9) August 1977 33p. AD-A044-199

In order to evaluate the adequacy of aircraft proximity warning and collision avoidance information pilot display, 14 alternative cockpit displays were compared to the original Intermittent Positive Control (IPC) BADCOM display in a subjective evaluation by 17 persons. A single display best incorporating the preferred features was then compared to the BADCOM display in a series of midair collisions simulated in the GAT-2 Flight simulator. It was found that the two-altitude sector presentation (NAFEC display) was significantly better than the three altitude sector presentation (BADCOM display) in terms of pilot performance. The pilots preferred the NAFEC display, because of the POSITIVE command approach; and they found the RESUME NAVIGATION command to be important, because it indicated when the threat had passed.

196. Eleccion, Marce

The Promise of Air Safety.

IEEE Spectrum vol. 12, no. 7, p. 26-36, July 1975

Summarizes the various collision avoidance systems being considered by the FAA.

197. Engholm, K.J.

Problems in Implementing BCAS.

AEEC Letter N76-106/AXX-00 October 11, 1976 4p.

Paper before the Avionics Engineering Seminar on "Beacon-Based Separation Assurance Systems", Munich, Germany, September 3, 1976. One of the major problems with the BCAS system is the reliability or efficiency of the communications link between the aircraft. Since this system does rely on each aircraft

sending out information by way of it's transponder so that it can be processed by BCAS equipped aircraft, the reliability of that information getting out and being properly interpreted by the BCAS aircraft is of the utmost importance. Ironically, the ACAS systems had a lesser problem than BCAS in this communications link reliability because they used a dedicated or clear channel for communicating while the BCAS system must share it's communications link with ATCRBS and later DABS.

198. Erickson, R.E.

Ground Based CAS Versus Airborne CAS.

Journal of Air Traffic Control vol. 15, p. 10-13, January-February 1973.

A compilation of Presentations made at the Air Traffic Control Association 17th Annual Meeting and Technical Program, 9-11 October 1972, Hotel Ambassador, Chicago, Illinois, p. 33-36.

It is considered that there is a growing need for air-derived collision prevention systems in airspace that is not under positive control. Honeywell's interrogator/transponder concept has been proven in the operation and flight evaluation of systems delivered to the U.S. Army. An operational pilot warning indicator, a tested advanced proximity warning indicator which includes relative bearing information, and a prototype collision warning system which has successfully undergone an extensive Army flight evaluation are described. Any system within this family of devices will communicate and function operationally with any of the others.

199. <u>EROS II</u>

Air Line Pilot vol. 41, no. 8, p. 27, August 1972

At the 1972 Air Safety Forum, McDonnell Douglas gave a live demonstration of EROS II collision avoidance system. The system was also demonstrated as an airport approach aid.

200. Erwin, R.L. et al

Strategic Control Algorithm Development. Vol. 1 -- Summary; vols. 2A & 2B -- Technical Report; vol. 3 -- Strategic Algorithm Report; vols. 4A and 4B Computer Program Report.

Boeing Commercial Airplane Co. Contract DOT-TSC-538 Report No. DOT-TSC-74-3 August 1974 6 vols. PB-236 718-SET N75-15632 -- N75-15637

Strategic control is an air traffic management concept wherein a central control authority determines, and assigns to each participating airplane, a conflict-free, four-dimensional route-time profile. This concept results in terminal area capacity increases, delay reductions, safety improvement, and controller workload reductions. Maximum benefits are expected to occur at the busy terminal areas where demand is high and airspace is at a premium. The results of a study to develop the basic algorithm for strategic control of arrivals are summarized. The strategic control concept is described as to operational concept, ATC system, airplane system and application to U.S. airspace.

201. The Estimation of P_{xz}: A procedure for Deriving the Numerical Value of the Probability of Overlaps in Both the Longitudinal and Vertical Dimensions within a System of Parallel Routes with Opposite-Direction Traffic.

ICAO Review of the General Concept of Separation Panel (RGCSP), Second Meeting WP/29 October 1973 30p.

This paper considers the computation of the longitudinal/vertical overlap factor which is necessary for the RGCS collision risk equation. The airspace in this study is less homogeneous than that considered by the NAT/SPG. An attempt is made at describing the overlaps between ascending and descending aircraft as well as level flight aircraft. The difference between this work and the NAT/SPG is that the "proximity" or "occupancy" concept in the NAT/SPG work is built into the overlap calculation here. The mathematical details are given and estimates are made of the P_{xz} on various European route sectors. A discussion of the sensitivities of various assumptions is given.

202. The Eyes Have It -- Profile of Midair Collisions.

TAC Attack vol. 13, p. 24-27, October 1973

203. EYES RIGHT!

Flight Safety Facts and Analysis vol. 3, no. 11, p. 19-20, November 1972

See and avoid is a must when piloting a plane as everyone has a built-in eye defect in the form of a blind spot, located in the eye where the optic nerve exits the eyeball on the way to the brain, within the field of vision of each eye 45 degrees from center. Space myopia occurs any time we are in a position where we don't have anything to focus on.

204. FAA Acts to Cut Down On Near Misses in Air.

AF Times vol. 36, p. 10, January 5, 1976

205. FAA Drops Conflict Alert Area Coverage Down to 12,500 Feet at 18 of 20 Centers.

Aviation Daily April 2, 1976 p. 198

FAA has completed work on conflict alert systems at 18 of its 20 enroute traffic control centers to provide coverage from 12,500 feet up.

206. FAA Enroute Centers to Get Conflict Alert System by December 23 (1975), FAA Says

Aviation Daily p. 237, December 15, 1975.

These ground conflict alert warning systems will allow ground controllers to be alerted to possible collision courses by aircraft above 18,000 feet, and in turn alert pilots to the danger.

207. FAA Evaluating Separation Standards on Flights to Hawaii.

Aviation Daily vol. 211, no. 12, p. 93, January 17, 1974

At present all Mainland-Hawaii flights are made along four routes which are separated laterally by a least 100 nautical miles. The aircraft also maintain a 2,000-foot vertical separation. The study is aimed at determining how closely aircraft adhere to the prescribed routes, the number of deviations which are made and the degree of those deviations.

208. FAA Gives Nod to Ground-Based Collision Warning.

Electronics vol. 48, no. 21, p. 49, October 16, 1975.

Announces the selection of a ground-based CAS system designed by consultant George Litchford and which will be built by Megadata Computer and Communications Corp.

209. FAA Hit on Regulatory Reform Safety Role, Collision Avoidance.

Aviation Week vol. 107, no. 24, p. 31-32, December 12, 1977

Before the House Government Operations government activities and transportation subcommittee, the FAA's administrator, Langhorne M. Bond, stressed the importance of the see-and-avoid concept as a backup to radar control. "The most important statistic which should be noted is that in the almost five-year period from 1973 to the present there have been no midair collisions involving an air carrier anywhere in the U.S."

210. FAA Moving To Implement Recommendations from Near Midair Collisions.

Aviation Daily March 11, 1976 p. 69

FAA is "moving speedily" to implement NTSB recommendations to prevent future near midair collisions due to system error and the human factor.

211. FAA Puts 'More Effort' in Collision Avoidance Development.

Aviation Daily vol. 201, no. 19, p. 158, May 25, 1972

Gustav E. Lundquist stated that FAA is "moving rapidly ahead in studies of airborne and ground-based devices to avoid aircraft collisions. FAA is interested in an independent airborne system, but "we do not believe there has been enough work at the present time to implement one."

212. FAA Reports Number of System Errors for the Past 10 Years.

Aviation Daily vol. 211, no. 34, p. 270 and reverse, February 19, 1974

FAA spokesmen have reported system errors average one for every three million control instructions. A system error occurs when prescribed separation standards between aircraft are not maintained.

213. FAA Supports Ground-Based Approach to Collision Avoidance.

Aviation Daily vol. 213, no. 17, p. 132, May 23, 1974

Quickest and cheapest way to avoid midair collisions is to make use of the existing and near-term capabilities of the current ground-based air traffic control system rather than airborne collision avoidance systems, FAA told a Senate subcommittee considering legislation which would require CAS on all aircraft. The agency is researching a ground-based system derived from the discrete address beacon system (DABS) which uses ground-based radar beacon equipment for basic signalling and synchronization. Intermittent Positive Control is also being studied.

214. FAA's Decision on Airborne CAS Delayed Till 1975.

Electronics vol. 47, no. 3, p. 59, February 7, 1974

The FAA plans to decide on a national standard for airborne collision avoidance systems no sooner than mid-1975, dashing the hopes of contenders Honeywell, McDonnell Douglas, and RCA. The FAA plans to tell the Senate it still believes ground-based approaches are better, despite congressional pressure for airborne CAS units.

215. Faber, Roy L.

Aircraft Collision Avoidance. Paper submitted toward a B.S. Degree at Stockton State College, May 16, 1974. 36p.

216. Factor Identification, Factor Combination and Future Work.

ICAO Second Meeting of the General Concept of Separation (RGCSP Panel) WP/25 October 1973 10p.

This working paper submits to the Panel a method for consideration of the various factors which affect separation minima, as well as certain relations that exist between these factors in a controlled air traffic system. The method is not intended at the outset to cover all the factors but attempts to be applicable to all forms of controlled separation. In particular it re-examines procedural separation and radar separation.

217. Failure to "See and Avoid" Caused Fighter-Light Twin Crash.

Aviation Daily vol. 233, no. 21, p. 167, September 30, 1977

The flight of F-4Es came up on the Cessna from the rear and above, so "it would have been impossible for the Cessna pilot to 'see and avoid' the F-4Es". NTSB said, "As this accident and others have shown, the 'see-and-avoid' concept of collision avoidance must be augmented with an automated system which can resolve potential collision conflicts." NTSB recommended that FAA install ultra high frequency (UHF) receivers capable of picking up the military UHF emergency frequency at all air traffic control facilities that handle military aircraft. NTSB also urged FAA to establish lines of communication between ATC facilities and military operation centers.

218. Failure To See Other Aircraft Cited In Midair Collision.

Aviation Daily vol. 221, no. 30, p. 239, October 14, 1975

Failure to see other aircraft probably led to the January 9, 1975 midair collision between a commuter airliner and a private airplane near Whittier, Calif., according to the NTSB. It believes each crew's ability to "anticipate and avoid the collision" was reduced because (1) the setting sun was behind the private plane; (2) the convergence angle of the two aircraft was about 90 degrees; and (3) the commuter crew was looking ahead for a police helicopter whose radar target had been reported by ATC. The aircraft--a Golden West DHC-6 and a Cessna 150.

219. Federal Aviation Administration

Conflict Alert System Goes Operational at K.C. Center.

News Release No. 75-155 November 7, 1975 lp.

This new system will assist controllers in handling traffic safely. The program starts the data tags blinking on the radar scope, alerting the controller to the possibility of a conflict when aircraft flight paths are projected to get closer than the required horizontal and vertical minimums.

220. Federal Aviation Administration

FAA Awards $527,000 for Collision Avoidance Work.

News Release 75-154 November 5, 1975 lp.

Litchford Electronics Inc. of Northport, N.Y. has been awarded a contract for two experimental models of a midair collision avoidance system that utilizes signals from existing aircraft equipment.

221. Federal Aviation Administration

FAA Contracts for Collision Avoidance Systems Studies.

News Release 74-109 July 12, 1974

FAA has approved two contracts totalling $340,632 for analytical studies and comparisons of alternative airborne collision avoidance systems (ACAS)--The Institute for Defense Analyses, Arlington, Va., and ARINC Research Corporation, Annapolis, MD.

222. Federal Aviation Administration

FAA Implements Conflict Alert Nationwide.

News Release No. 76-01 January 12, 1976 lp.

The FAA has completed the nationwide installation of its conflict alert system which flashes a warning signal on the radar displays used by air route traffic controllers to alert them when aircraft are projected to be in possible conflict with one another.

223. Federal Aviation Administration

NAS EN ROUTE STAGE A -- Conflict Alert Function.

Order 7110 68A March 3, 1976 4p.

This order establishes procedures and parameter values to be used with the conflict alert function of the NAS En Route Stage A System.

224. Federal Aviation Administration

An Overview of the FAA Engineering & Development Programs.

Report No. EM 73-2 March 1973 57p. AD 758 284

The purpose of this document is to provide an overview of the FAA's engineering and development programs, indicating long-term directions and highlighting progress during FY 1973 and expected achievements during FY 1974. The programs are summarized and their funding tabulated.

225. Federal Aviation Administration

An Overview of the FAA Engineering & Development Programs with Highlights of Fiscal Years 1974-1975.

Report No. EM 74-8 March 1974 74p.

The purpose of this document is to provide an overview of the Federal Aviation Administration's engineering and development program indicating long-term directions and highlighting achievements in FY 1974 and the expected 1975. This report updates the first document (March 1973) and adds new information on the plans for the upgraded third generation air traffic control system and on the impact of the E&D program on airport capacity and on general aviation users.

226. Federal Aviation Administration

An Overview of the FAA Engineering and Development Programs with Highlights of Fiscal Years, 1975-1976.

Report No. EM 75-4 April 1975 29p. AD-A010 266 N75-29063

Progress is summarized in the areas of air traffic control, approach and landing systems, aeronautical satellites, radar navigation, aircraft safety in terms of reduction of accident fatality, and airport surface traffic control. Emphasis is placed on aircraft safety.

227. Federal Aviation Administration

Summary of Near Term Engineering and Development Program Plans for Ground Based Separation Assurance.

Report EM 73-7 March 1973 25p. N73-24654

A description is given of several engineering and development activities directly involved with the development of automation

capabilities to aid the separation assurance function of the ground based air traffic control system. In addition to work on ground based separation assurance a parallel program is being conducted to determine the potential value of an independent airborne collision avoidance system as a safety backup in the event of ground system failures.

228. Federal Aviation Administration

Terminal Conflict Alert (CA).

Advisory Circular No. AC 90-77 September 1, 1977 2p.

A program being implemented alerts controllers to closures between two or more aircraft that require immediate attention. To provide this alert, an automated conflict detection function called terminal conflict alert (CA) is being incorporated in the ARTS III computer's software program.

229. Federal Aviation Administration, Air Traffic Service

Air Traffic Control.

Handbook 7110.65A January 1, 1978 272p.

This handbook prescribes air traffic control procedures and phraseology for use by personnel providing air traffic control services. Separation procedures are given.

230. Federal Aviation Administration, Air Traffic Service

Terminal Conflict Alert (CA).

Notice N 7110.514 August 26, 1977 2p.

The Notice prescribes terminal conflict alert (CA) procedures.

231. Federal Aviation Administration, Associate Administrator for Air Traffic and Airway Facilities.

Consultative Planning Conference on Aircraft Separation Assurance: Presentations.

FAA Report ATF-4-76-1 September 27, 1976 154p. AD-A032 354 N77-22066

This document contains the vu-graphs presented at the Conference, the purpose of which was to inform and solicit comments from the aviation user groups on the FAA's proposed ASA program. Information is given concerning FAA's decision not to proceed with Airborne CAS and PWI but to select Beacon-based CAS and IPC.

232. Federal Aviation Administration, Interagency Group on International Aviation

Comments on the Work of Working Group-C of the RGCSP in Determining Lateral Separation Minima for Parallel Routes in En Route Areas.

IGIA 83/8.7 Third Meeting of the ICAO Review of General Concept of Separation Panel, Montreal, Canada, August 18--September 5, 1975 July 29, 1975 51p.

The purpose of this paper is to comment on the Working Group 'C' analysis of collision risk to determine lateral separation minima. It has two parts. First covers the situation when surveillance is not in effect, the second covers the situation when surveillance is used for air traffic control. The first part covers the model, target levels of safety, the data, and application of the data to the model. The second covers simulations and a method of estimating collision risk when surveillance is in effect.

233. Federal Aviation Administration, Interagency Group on International Aviation

The Variability of P_{xz} and Its Effect on the RGCSP Calculated Separation Value.

IGIA 72/1.203 April 16, 1976 10p.

Working Paper for use by the U.S. Delegation at the 9th Air Navigation Conference, Montreal, April 21 to May 14, 1976. The paper is related to Agenda Item 1, Separation between Aircraft. The purpose of this paper is to present a brief discussion of the sensitivity of calculated collision risk and the derived separation value to one of the basic parameters in the model.

234. Federal Aviation Administration, National Aviation Facilities Experimental Center

Conflict Prediction.

Letter Report Project No. 142-174-020 No. NA-22-75-LR December 12, 1975 3p.

A test and evaluation of the UNIVAC-developed Conflict Prediction program for ARTS-III Enhancement was conducted at NAFEC in the Terminal Automation Test Facility (TATF) from May 1974 to June 1975. The program was designed to provide an effective alert to the controller of a predicted conflict.

235. Federal Aviation Administration, Office of Systems Engineering Management

Engineering and Development Program: Goals, Achievements, Trends. March 31, 1972 179p. N72-23980

Engineering and Development progress achieved during 1 April 1971 to 31 March 1972 is reported for FAA top management, DOT, FAA services, Offices, Regions, Centers and the aviation community. The emphasis is on the system, terminal tower control, runways/taxiways, aircraft safety, and support programs. Beacon, navigation, landing system, weather studies are described, and the radar, communication, oceanic, flow control, enroute control, flight service station, technology, satellite, environmental protection, and pilot warning indicator/collision avoidance system programs are also covered.

236. Federal Aviation Administration, Office of Systems Engineering Management

Engineering and Development Program Plan. Intermittent Positive Control.

Report No. ED 01-3 October 1973 41p. AD 773 397/5GA

The report outlines a research and development program leading to the development and evaluation of the Intermittent Positive Control (IPC) function. This work is being undertaken as part of FAA efforts to improve and upgrade the present air traffic control system.

237. Federal Aviation Administration, Office of Systems Engineering Management

Engineering and Development Program Plan -- Terminal/Tower Control, Interim report.

Report No. ED 14--2 April 1973 pages 6-53 to 6-64.

Discusses subprogram 142-174, Conflict prediction and Resolution.

238. Federal Aviation Administration, Office of Systems Engineering Management

Summary of Near Term Engineering and Development Program Plans for Ground Based Separation Assurance.

Report EM 73-7 March 1973 24p. AD 761 560

There is much promise for significant safety improvement for non-controlled traffic after the Discrete Address Beacon System with its data link are implemented during Phase II of the Upgraded Third Generation System. It should then be possible not only to detect potentially hazardous encounters between controlled and non-controlled aircraft that are beacon equipped,

but also to send traffic advisories and intermittent control instructions automatically by data link to the non-controlled aircraft equipped with DABS to prevent unsafe situations from developing. This is called Intermittent Positive Control and is a major objective for the 1980's.

239. Federal Aviation Administration, Systems Research and Development Service.

Analysis, Flight Test and Evaluation of Honeywell, McDonnell-Douglas and RCA Airborne Collision Avoidance Systems (ACAS).

Report RD 76-17 January 1976 56p. AD-A021 097 N76-23236

Three Airborne Collision Avoidance Systems (ACAS), designed and built by Honeywell, McDonnell-Douglas and RCA respectively, were evaluated as part of the aircraft separation assurance program. The evaluation consisted of analyses, simulations and maneuver selection logics developed by the Air Transportation Association ACAS technical working group as a standard for comparison. The results show that the Honeywell system is superior from both a cost and technical performance standpoint.

240. Federal Aviation Administration Will Evaluate Two Recent Concepts in Airborne Collision Avoidance Systems.

Aviation Week & Space Technology vol. 102, no. 16, p. 43, April 21, 1975

One system would involve the addition of an ATCRBS type interrogator and signal processor, while the other system is one devised by Litchford Associates and is based on the use of existing transponders.

241. Federal Law for Midair Collision Liability Prevails Over State Laws.

Aviation Daily vol. 219, no. 12, p. 114, May 21, 1975

Supreme Court has refused to review lower court decisions involving a 1969 midair collision between an Allegheny DC-9 and a Piper Cherokee near Indianapolis, Ind. The Supreme Court's action lets stand an appeals court decision that there is a federal law of contribution and indemnity governing midair collisions.

242. Federman, P.J. and Siegal, A.I.

Survey of Thin Film Fluorescent Material.

Applied Psychological Services, Inc. Contract DOT FA73WA-3320
Report RD 74-9 December 1973 70p.

The advantages and disadvantages of thin film adhesive fluorescent material for marking aircraft are discussed. Information relative to the experiences of users of this material is presented along with the most current opinions of manufacturers of the films, pigments, and adhesives from which thin film fluorescent material is constructed. Thin film materials are compared with polyurethane paint and with fluorescent paint for marking aircraft from the points of view of added drag, added weight, and cost/utility. The analysis suggests support for the use of the thin film fluorescent materials on the basis of: possible conspicuity enhancement, minimum added weight, no differential drag effects, and a favorable cost/utility ratio.

243. Feldman, Joan

The Collision Avoidance Caper.

Government Executive vol. 4, no. 6, p. 36-37, 40, June 1972

Review of recent developments and brief interview with FAA Administrator John Shaffer.

244. Ferguson, John

The Case for the Logo Light.

Air Line Pilot vol. 41, no. 6, p. 29, 45, June 1972

The lights can pay their way in public-relations image and may even occasionally speed up identification and taxi clearance on the ground. However, in flight those lights can play an important collision avoidance role, since the illuminated vertical fin resembles a huge sail that can be seen for miles.

245. Ferlet, G.

Analysis and Development of Hybrid Navigation Systems--Application to Area Navigation.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany, October 2-5, 1973. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 2. 18p.

A general system for studying air navigation is proposed. Experimental hardware and a software tool were designed to allow for the rapid analysis and adjustment of any type of hybrid navigation system. An area navigation system of the inertia-VOR-DME type using Kalman's optimum statistical filter methods is described.

246. Fernandez, R.

The Safety of Flight Operations.

IAA/Ingenieria Aeronautica y Astronautica vol. 27, p. 57-72, August-September 1976 In SPANISH

Aircraft accidents and their causes are examined and typical operational problems are investigated. Among the various types of accidents covered, collision-related accidents are also discussed and attention is given to cases in which the human factor must be held responsible for the accident.

247. Field, Hugh

The Air Traffic Control Dilemma.

Flight International vol. 101, no. 3298, p. 756-758, May 25, 1972

Two airmiss incidents occurred in the Midhurst area on the morning of May 1, 1972. The first involved a BOAC VC10 and a BOAC Boeing 707 at a height of 8,000 ft.-9,000 ft. and this was followed ten minutes later by another BOAC Boeing 707 approaching close to a Boeing 747 at approximately 10,000 ft. Both incidents are under investigation.

248. Findley, D.E.

Satellite Considerations in Future Air Traffic Control Systems.

In: AGARD CP-105 Air Traffic Control Systems. April 1973 9p.

A program for improving the air traffic control systems of the United States is discussed. Development efforts are proposed for the following subjects: (1) traffic surveillance; (2) conflict prediction; (3) resolution and avoidance; (4) landing guidance; and (5) automation of air traffic control functions.

249. Fink, Harold

Chairman of the DABS/IPC/BCAS task force of ATA's Communications Committee report on the FAA's progress with the development of these systems.

Report of the July 20-21, 1977 AEEC General Session held in San Francisco, California. AEEC Letter 77-119/AGS-31 October 26, 1977 page W-7

A U.S. National Aviation Standard for DABS is currently being drafted with a mid-1978 goal for its completion.
Flight tests have shown that the computer algorithms developed to evaluate threats and generate collision avoidance maneuver commands for IPC needed further refinements to improve pilot acceptance and to make the maneuvers more compatible with ATC use of the airspace. As for the BCAS system, steps are being taken to make the system generate fewer garbled replies and to track through garble more effectively. Also to be investigated is the potential of the BCAS to interfere with the beacon system. FAA plans to develop the passive BCAS into a multimode system (active, passive and hybrid active/passive) incorporating threat evaluation and maneuver command generation logic more sensitive to the problems of CAS/ATC interaction than the ANTC 117 logic used so far.

250. Fink, Harold H.

Airline Industry View of BCAS.

AEEC Letter N76-106/AXX-00 October 11, 1976 4p.

Paper before the Avionics Engineering Seminar on "Beacon-Based Separation Assurance Systems", Munich, Germany, September 3, 1976. He emphasizes that it is particularly important to have separation assurance within high-density takeoff and landing areas. For this reason, a DABS/Automatic Separation Assurance (DABS/ASA) system must function satisfactorily in those areas, whether or not BCAS proceeds. A single transition to a new ATC transponder is essential.

251. Finnegan, Patrick

Flight Test Evaluation of AVOID II (Avionic Observation of Intruder Danger) Collision Avoidance System.

Naval Air Development Center, Naval Navigation Laboratory Contract DOT-FA73-WAI-358, Report No. NADC-76141-60 October 1976 207p.
AD-A033 596 N77-22061

AVOID is a candidate for a national standard collision avoidance system. A comprehensive flight and laboratory evaluation of the AVOID II version was conducted including the ability to communicate accurately and with sufficient distance to provide timely and correct advisories and maneuver commands in simulated high traffic density.

252. Fitzwilliams, O.L.L.

In Search of a Radar for the ITV System.

Westland Helicopters, Ltd. Report No. RP-532 September 1976
N77-15020

A system of air transport for the future, based on the concept of the Independently Targeted Vehicle (ITV) is described. Operation of very large numbers of small vehicles offers the traveller an automatic airborne traverse at 200kt ground speed between air stations very close to the origin and destination of any journey. Simulations have demonstrated stable collisionless traffic at high density but assurance was required that suitable radar equipment can be developed. A form of radar which would be effective was identified, free of interference and within acceptable dimensions and cost.

253. Flanders, James H., Grundy, Peter A., and Carlson, Neal A.

PWI Systems Survey.

Intermetrics Incorporated Final Report No. DOT-TSC-188-2
15 November 1971 156p. PB-212 496 N73-16020

This survey report presents a compilation, classification, and review of 176 documents related to PWI and CAS research and development.

254. Follen, Robert J.

The Case for a Transponder Concept in Collision Avoidance.

ICAO Bulletin vol. 28, no. 11, p. 28-31, November 1973

A family of co-operative collision prevention devices has evolved from a simplified proximity warning system in operational use since 1970. The basic difference between CAS and PWI is the fact that the PWI does not establish or command the pilot to make an evasive maneuver. The pilot remains the decision maker.

255. Form, P.

Digital Synchronization for Time Synchronized Collision Avoidance Systems in Air Transport.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany October 2-5, 1973. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 2, 18p.

The concept of ATA collision avoidance is considered along with details regarding the technique for synchronized transmission

and measurement, the suitability of CAS-synchronization signals for frequency synchronization on board, and aspects of digital synchronization of phase and frequency on board. The atomic clock on board is replaced by a digitally/controllable frequency generator, also called 'synthesizer'. This generator shunts all necessary frequencies for the synthesis of the clock pulse frequency from a thermostat quartz oscillator as control oscillator. Limitations in the concept of time synchronized system are also discussed.

256. Form, P.

Digital Synchronization of Synchronous Collision Prevention Systems in Aviation.

Deutsche Gesellschaft fur Luft- und Raumfahrt and Deutsche Gesellschaft fur Ortung und Navigation, Symposium uber neue Anflugverfahren, Dusseldorf, West Germany, May 2-4, 1973. Paper DG-LR 73-012 18p. In German N73-32519

Discussion of the usability of the digital synchronization concept for reducing the complexity and costs of the airborne equipment required in synchronous aircraft collision avoidance systems. Following a review of data transmission and measurement techniques currently favored for synchronous aircraft collision avoidance systems, the synchronization function itself is examined in terms of primary, incipient secondary, and continuously secondary synchronization, and the problems involved in the synchronization of a multitude of collision-avoidance system participants in motion are considered. The digital phase and frequency error correction or synchronization system is then described and its collision-prevention effectiveness and cost efficiency pointed out.

257. Form, P.

Possible Applications for an Integrated Communication, Navigation and Identification System.

Ortung und Navigation no. 3, p. 65-74 (1974) In GERMAN

258. Form, P.

The State of Development of DABS.

Ortung und Navigation no. 1, p. 79-99 (1974) In GERMAN

The principles of operation of DABS are discussed along with details regarding a synchronized discrete-address beacon system.

259. Form, Peter

Digital Synchronization for Time Synchronous Collision Avoidance System in Aviation.

Technische Universitaet. Brunswick, West Germany. Ph.D Thesis 1974 127p. In German. N74-35098

The development, characteristics and operation of a time synchronized air traffic control system for collision avoidance are discussed. The performance of a stationkeeping system which lead to the development of the time synchronized collision avoidance system is analyzed. The ground-to-air and air-to-air features of the system are explained. A numerical analysis of the digital synchronization provisions is developed. Diagrams of the typical air traffic control problems are used to explain the theoretical aspects of the system.

260. Formation Mid Air Collisions.

Approach vol. 17, no. 11, p. 1-4, May 1972

It stands to reason that aircraft flying in close formation through maneuvering flight have more of a chance to collide with each other than do aircraft going their separate ways. Formation midair collisions almost invariably involve pilot factor.

261. Francis, Edward G.

Our Own Worst Enemy

Aerospace Safety vol. 30, no. 3, p. 7, March 1974

Review of 1972 and 1973 Air Force Formation Collisions.

262. Frank, Herbert J.

Statement of the President, Aerosonic Corp., Clearwater, Fla.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 147-148.

His company has been manufacturing aircraft instruments and working since 1964 on simple, inexpensive, anticollision devices for the light aircraft. He maintains that the aviation industry has survived in spite of the FAA. In the FAA everybody is looking for perfection and nobody is interested in halfway fix. He made a plea that the program is "Buy American" 100% in

order that the program can keep the manufacturers in business rather than letting the Japanese and Far East nations completely wreck our aircraft avionics and instrument manufacturing business.

263. French ATC Situation Clouded by Midair.

Aviation Week & Space Technology vol. 98, no. 11, p. 25-26, March 12, 1973

Collision on March 5 between an Iberia McDonnell Douglas DC-9 and a Spantax Convair 990 while under control of military tower personnel due to a strike of civilian controllers. France's transport minister Robert Galley, absolved the military controllers of blame 24 hr. after the accident and declared that preliminary evidence indicated the Spantax pilot was at fault. He committed three errors leading to the accident.

264. French Board Analyzes Midair Collision.

Aviation Week & Space Technology vol. 103, no. 2, p. 58-60, July 14, 1975; no. 3, p. 74-75, 77-78. July 21, 1975; no. 4, p. 57-58, July 28, 1975.

Report of the Commission of Inquiry appointed by the French Secretariat of State for Transport to investigate the midair collision of an Iberia McDonnell Douglas DC-9 and a Spantax Convair 990 near Nantes, France, March 5, 1973. Both aircraft were of Spanish registry. Seven crewmembers and 61 passengers on the Iberia aircraft were killed, the aircraft was wrecked and cargo destroyed. The Spantax aircraft incurred substantial damage but there were no injuries to crewmembers or passengers. The assignment of the same flight level by the control to the two aircraft, due to arrive at Nantes at the same time, created a source of conflict. The flight of the BX 400 was affected by delays attributable in part to the control, in part to the crew and also to difficulty in air/ground communications resulting in complete failure of the crew and the control to understand one another.

265. French Collision Reports Arouse Opposition.

Flight International vol. 108, no. 3445, p. 443, March 20, 1975

Spantax and pilot associations are reacting strongly to French handling of publication of the final report on the mid-collision near Nantes on March 5, 1973, between an Iberia DC-9 and Spantax Coronado. The determining cause of the accident is the right turn effected by the crew of the Coronado on their own initiative, in the vicinity of an important route crossing,

without external visibility, without radio contact with control on the frequency indicated, and corresponding to the sector in which they were flying, without knowing their position exactly, and without the authorisation of anyone. The controllers had not foreseen that the crew would pay so little attention to its navigation or that they would be so passive in their reactions and also so ignorant of the procedures.

266. Frings, M.

Collision Law Aspects of the International Air Transportation Agreement.

Zeitschrift fur Luft- und Weltraumrecht vol. 26, p. 8-22, March 1977
261 refs. In GERMAN

Legal liability and compensation is qualified in the context of air collision law. Various aspects of the collision law section of the international air agreement are discussed and the possibilities of working out a single unified air collision norm are considered.

267. Frutig, Judith

U.S. Puts Collision Warnings in 20 Airport Control Systems.

Christian Science Monitor December 11, 1975 p. 1, 9.

Conflict alert warning systems for air route traffic control centers will be installed by December 23. A priority order came after a rash of near-collisions and air space violations were reported during the past month.

268. Gados, R.G. et al

A Proposed Metering and Spacing System for Denver.

Mitre Corporation Contract DOT-FA69NS-162 Technical Report MTR-6865
March 1975

The paper includes (1) a functional description of MITRE's proposed M&S system, (2) a specific geometry design and sensitivity analysis comparing the proposed system's performance to that of automating current procedures, (3) an estimate of the proposed system's performance via computer simulation, and (4) computer flow diagrams of the scheduling and control aspects of the proposed system.

269. Gados, Ronald George

An Optimization Approach to Automated Air Traffic Control for Unstructured Airspace

Clarkson College of Technology Ph.D. Thesis. 1975 197p. Univ. Microfilms Order No. 75-16939

This thesis describes a heuristic algorithm which automatically predicts and resolves air traffic conflicts in an unstructured, three dimensional airspace environment. The optimization algorithm incorporates the existing winds and the projected positions of other aircraft to determine a flight path by which each aircraft can safely pass through the Air Traffic Control system in a minimum amount of flight time.

270. Gagne, Gilbert A. and Hershkowitz, Ronald M.

Oceanic Surveillance and Navigation Analysis, FY72.

Transportation Systems Center Report No. TSC-FAA-72-26 (FAA-RD 72-142) August 1972 76p. AD 757 274

A methodology has been developed by Systems Control, Inc. for relating the safety (Collision risk) of the North Atlantic organized Track System in the lateral dimension to the general characteristics of the on-board navigation system, the independent satellite surveillance system and the ATC procedures. The analysis and results are detailed herein. Extensions of this methodology to the latitude and vertical dimensions are also discussed and preliminary results are presented.

271. GAO Calls for Better System to Prevent Midair Collisions.

Aviation Daily vol. 216, no. 6, p. 46, November 8, 1974

General Accounting Office has issued a report to Congress calling for an "FAA analysis of all alternate solutions" to the midair collision problem. The report said present FAA efforts are restricted to ground control of less than 30% of flight operations, predominantly "airlines and other high-performance planes." Virtually all recent midair collisions have occurred when air traffic control had only one, or neither, aircraft under control, GAO said.

272. Gardner, Bob

See What You Are Looking For.

MAC Flyer vol. 20, p. 10-12, April 1973

While there are no fail safe procedures to follow to avoid midair collisions, your own eyes are the best preventive devices you have.

273. Garrison, Paul

See and Avoid

Business & Commercial Aviation vol. 31, no. 6, p. 62-63, 72, December 1972

Neither new rules nor improved technology can take the place of the oldest and still foolproof method to 'SEE and Avoid'. The danger of midair collision is greatest at uncontrolled airports below 100 feet agl on final.

274. Gely, A.

Air Collision Prevention.

Navigation (Paris) vol. 20, p. 313-329, July 1972 (In FRENCH)

General review of the causes and prevention of air collisions. The "rules of the road" originally developed for maritime traffic, and adapted for air traffic, are now inadequate. However, the necessity of keeping a lookout remains, and the responsibility for this remains with the pilots. Of the factors affecting the possibility of perceiving an object, moving or not, speed is the most critical. Some typical collisions are analyzed, and airborne and ground-based anticollision devices and procedures are described and compared. IAA--A72-37800

275. Gent, H.

A Measuring Rod for ATC Systems, The Index of Orderliness.

In: Plans and Developments for Air Traffic Systems. Papers presented at the 20th Symposium of the Guidance and Control Panel, held in Cambridge, Mass., 20-23 May 1975. AGARD Conference Proceedings No. 188 Paper No. 40 8p.

The 'index of orderliness' is considered as a measuring rod for ATC systems which gives a numerical estimate of system performance at any moment of time. Its calculation requires a basis for conflict prediction and a threat weighting formula. The index is then defined as a weighted count of future conflicts. The index of orderliness/time curves produced by a collision avoidance system simulation is discussed. It is shown that such curves contain valuable information on the response time of the system.

276. Geoghan, Robert D., Jr.

Interface Definition. DABS Engineering Model/ATC (NAFEC). Vol. 2, Series 1: Enroute Data Formats.

Mitre Corporation Contract DOT-FA69NS-162 FAA Report RD 74-159 vol. 2 (MTR-4221-Vol. 2, Ser. 1) March 1975 30p. AD-A013 810 N76-13046

The surveillance and communication message formats are described for the interface between the DABS Engineering Models and the NAS Enroute System at NAFEC. This interface will be used for IPC Phase II testing and development testing of the DABS system.

277. George Litchford Patents Collision-Avoidance System.

IEEE Spectrum vol. 12, no. 3, p. 90, March 1975

Two patents were recently granted on an aircraft collision avoidance system in which aircraft would use signals from the existing air traffic control system and automatic responses made by transponders.

278. Giallanza, Frank V., Giallanza, Charles P. and Brown, James C.

Potential Conflict Prediction and Associated Functions for Oceanic Air Traffic Control Automation.

Meta Systems, Inc. Contract DOT-FA72WA-2851 Project no. 102-150 FAA Report RD73-73 May 1973 55p. AD-767 453 N74-13427

Algorithms to determine potential conflicts over an oceanic airspace based on given vertical, lateral, and longitudinal separation criteria were developed. Associated functions used by air traffic controllers to resolve conflict situations are also described.

279. Gilbert, Glen A.

Historical Development of the Air Traffic Control System.

IEEE Trans. on Communications vol. COM-21, no. 5, p. 364-375, May 1973

In 1933 instrument flying commenced, and by 1935 several airlines jointly established the first Airway Traffic Control Centers to safeguard their aircraft against midair collisions.

280. Gilbert, Glen A.

Statement of the Consultant Principal of Glen A. Gilbert Associates.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 23-28.

Spoke on Area Navigation and its potential role in contributing to a reduction of the midair collision hazard.

281. Gilbert, Gordon

FAA Is Readying an Expanded BCAS Evaluation Program.

Business and Commercial Aviation vol. 41, no. 4, p. 15, Ocotber 1977

Through its NAFEC facility, FAA will shortly begin an extensive evaluation of a collision avoidance system based on the ATC transponder and altitude encoder (BCAS). The FAA's target date for completion of the study and recommendation of a national collision avoidance system standard is October 1981.

282. Gilsinn, Judith and Shier, Douglas R.

Mathematical Approaches to Evaluating Aircraft Vertical Separation Standards.

National Bureau of Standards, Applied Mathematics Division Contract DOT-FA76WAI-594 FAA Report EM 76-12 (NBSIR 76-1067) May 1976 49p. AD-A031 853

Above Flight Level 290, current regulations require aircraft to be separated vertically by at least 2000 feet. Because of increased traffic desiring to fly at these altitudes, the possibility of reducing the required separation (while maintaining acceptable safety levels) is under study. This report details many of the components of vertical position error, altimeter instrument error, and pilot response error. Two models for use in evaluating separation standards, the root sum of squares approach (RSS) and Reich collision risk model, are described together with their respective advantages and disadvantages.

283. Gilsinn, Judith F.

Mathematical Approaches to Evaluating Aircraft Vertical Separation Standards.

National Bureau of Standards, Operations Research Section Contract DOT-FA76WAI-594 Report NBSIR 76-1067 May 1976 50p. PB-257 195 N77-15023

Many of the components of vertical position error are detailed and classified into three major categories: static pressure system error, altimeter instrument error, and pilot response error. Two models for use in evaluating separation standards, the root sum of squares approach and the Reich collision risk

model, are described together with their respective advantages and disadvantages. A final section includes recommendations for a carefully designed data collection effort and discusses potentially important considerations for such a design.

284. Glines, C.V.

Ar^ Two-Pilot Jetliners Unsafe?

Air Line Pilot vol. 43, no. 11, p. 7-10, November 1974

Compares the number of fatalities for the DC-9 and the B-727. There have been more fatalities in DC-9s although they have not been in service as long as the B-727 and there are fewer of them flying. The DC-9 also shows a greater midair collision rate than the B-727 for the period 1963-1973.

285. Glover, R.T. and Musillo, A.J.

Midair Collision Prevention for Army Aircraft.

Institute of Navigation, Annual Meeting, 28th, U.S. Military Academy, West Point, N.Y., June 27-29, 1972, Paper, 23p.

This paper discusses the midair collision problem and the present collision warning technique being developed by the U.S. Army. The Avionics Laboratory, USAECOM, has a continuing program to develop a collision warning system. This program is directed toward providing U.S. Army aircraft operating in tactical airspace with a means of collision prevention. The technical approach is based on the proximity warning devices developed for and operational at the U.S. Army Aviation School and Center at Fort Rucker, Alabama. A modification of three proximity warning devices to obtain a collision warning capability for feasibility flight test was awarded to Honeywell, Inc. As a result, three ECOM collision warning devices were developed by Honeywell under an ECOM contract. An extensive feasibility flight test was conducted by ECOM with the three systems installed in an OH-58, UH-1 and OV-1. The test also demonstrates that the system can be utilized in both high speed Army fixed wing aircraft and small helicopters. (Author)

286. Goblick, T.J.

DABS Modulation and Coding Design. A Summary.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72WAI-261 FAA Report RD 75-93 (ATC-52) March 1976 105p.
AD-A024 471 N76-28216

The Discrete Address Beacon System (DABS) designed as an evolutionary replacement for the Air Traffic Control Radar Beacon System (ATCRBS) is described. As with ATCRBS, DABS is a cooperative Air Traffic Surveillance System utilizing ground based sensors (interrogators) and airborne transponders. In addition to its surveillance function, DABS integrally accommodates ground-to-air and air-to-ground data link communication within the interrogations and replies. In DABS each aircraft transponder may be individually interrogated, using its unique 24-bit address, giving the ground based interrogators freedom to schedule interrogations and replies to make efficient use of the channels essentially independent of the air traffic distribution. The report presents the rationale for the selection of the DABS signaling waveforms and error control techniques.

287. Goggins, R.V.

AVOID-II Collision Avoidance System (M) Operating Instructions.

Honeywell, Inc. for Naval Air Development Center. May 1975 64p.
Appendix B to Naval Air Development Center Report NADC 76141-60
October 1976

AVOID-II is an aircraft Collision Avoidance System that generates advisories and/or commands based on the relative altitude, range, and range rate of all intruder aircraft. The advisories provide the pilot with a visual indication of safe maneuvering limits. The commands indicate the appropriate escape maneuver.

288. Goggins, Roger V.

AVOID Interrogation and Fruit Rates.

Honeywell, Inc. Customer Engineering Letter to James J. Bagnall, Jr.
December 26, 1974 23p. Appendix A to: Naval Air Development Center
Report No. NADC-76141-60 October 1976

Summarizes the results of a study conducted to determine the interrogation and fruit rates expected in the Los Angeles Basin in 1982. All IFR aircraft were assumed to be equipped with the AVOID-I CAS (15% of the mix) and VFR aircraft were equipped with AVOID-II (85% of the mix). The results of the calculations are given.

289. Golden, John F.

IPC Flight Test Plan.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6801
February 1975 87p.

The plan describes the method for conduction of Intermittent Positive Control flight tests at the Discrete Address Beacon System Experimental Facility. Specifically addressed are the objectives of testing, IPC operational description, resources, flight test operations, and data reduction and safety procedures. A catalog of flights is included.

290. Golden, John F.

A Pilot's Guide to Intermittent Positive Control.

Mitre Corporation Document No. M75-61 (October 1975?) 19p.

An illustrated booklet to explain the value and use of IPC to enhance the "see-and-avoid" method of preventing midair collisions.

291. Goldwater, B.M., Jr.

Criticism of FAA Handling of Collision Avoidance Systems.

In: Upgrading the ATC System; Proceedings of the Annual Meeting, Washington, D.C., November 28, 29, 1973. Washington, D.C. Radio Technical Commission for Aeronautics, 1973. 6p.

There has been an average of 34 civil aviation collisions with 69 fatalities per year in the United States. In addition, in 1968, there were reported 2230 near midair collisions. The FAA is apparently opposed to an independent airborne collision avoidance system. Alternative approaches considered by the FAA are examined, giving attention to SYNCHRO-DABS. The qualifications of a proximity warning device are evaluated.

292. Goldwater, Barry M. Jr.

CAS Isn't Getting a Fair Shake.

Journal of ATC vol. 16, no. 2, p. 12-14, March-April 1974

Paper presented to the Radio Technical Commission for Aeronautics, November 28, 1973. Congressman Goldwater recommends that we must insure an unbiased and fair evaluation of all competing alternative approaches to aircraft separation assurance. Establish common separation assurance standards under which all techniques, ground-based or air-derived, can be evaluated. Insist on a detailed program which will allow for mandatory installation of airborne or PWI, should the evaluation prove economically and technically feasible and advisable, by 1980.

293. Goldwater, Barry M., Jr.

Congressman Speaks out on Collision Avoidance.

Air Line Pilot vol. 44, no. 2, p. 11, 44-45, February 1974

Republican Representative from California speaks out on the lack of a collision avoidance system.

294. Goodwin, John W.

Intermittent Positive Control -- Phase I, Operational Test and Evaluation.

FAA, NAFEC Project 122-114-610 Report RD 77-125 (NA 77-12) October 1977 16p.

This report reflects the results of an effort at NAFEC to test and evaluate the interface between the IPC system and the enroute air traffic controller. The results of the tests reveal that the IPC controller alerts, consistency of commands, readability of displayed information, and method of displaying information to the controllers were acceptable. The issuance of negative commands to aircraft presents a problem to the controllers, in that negative phraseology is not utilized in the ATC system. The alerting methods of IPC and conflict alert are similar, but because of the critical timing of the IPC alert, it was felt that a distinctly different alert for IPC should be utilized.

295. Gouillou, R.

A Time-Frequency High Performance Collision Avoidance System.

Institute of Navigation, Annual Meeting, 28th, West Point, N.Y., June 27-29, 1972. ONERA TP no. 1091, (1972) 7p. N72-26523

Study of a collision avoidance system (CAS) complying with ARINC specifications, in order to analyze its feasibility and to provide precise elements regarding the time-frequency CAS. The ONERA-Crouzet system includes a computer, a transmitter, and a receiver. The local oscillator is a rubidium clock. Flight tests were performed with two DC-7 aircraft fully equipped with electronic devices, plus a piece of ONERA equipment which permitted comparison of the time standards of Paris, Braunschweig, Greenwich, Ottawa, and Washington, with an overall accuracy of 15 nsec. Results from McDonnell-Douglas, Bendix and Sierra-Wilcox systems, which have been tested elsewhere, are compared. All the CASs present a velocity jitter larger than requested, and a noticeable sensitivity to multipaths.

A message format is defined which respects the ARINC specifications as much as possible, including a pulse usuable for 800 microsec for the velocity measurement, and permitting the automatic adjustment of the receiver sensitivity. IAA--A72-37764

296. Graham, Dunston, Clement, Warren F. and Hoffmann, Lee Gregor

Manual Control Theory Applied to Air Traffic Controller-Pilot Cooperation.

In: NASA, Washington 7th Annual Conference on Manual Control, 1971 NASA-SP-281 (1972) p. 73-80

Reduced runway separation standards are among the means which have been proposed for increasing airport capacity. The probability of a blunder will dominate the calculation of safe separation standards. Then the determinant of safe system performance will be the system reaction time comprised of the air traffic controller's detection, decision and communication delays, and the response times of the pilot and aircraft in executing a collision avoidance maneuver.

297. Graham, W.

Aircraft Pilot Warning Instrument (APWI) Study.

Control Data Corp. Contract DOT-FA70WA-2263 FAA Report RD75-59 vol. 1 March 1975 167p. AD-A022 621 N76-24191

The factors by which the expected number of collisions could be reduced by the implementation of Proximity Warning Instruments (PWI) having various performance characteristics are estimated. If both aircraft involved in an encounter are equipped with high performance PWI (sharp range and altitude cut-offs, and 2 deg relative bearing accuracy) then it is estimated that the expected rate of collision itself is estimated to be highly effective, as judged by the number of potential collisions that are avoided, but the residual collision risk is unacceptable to the public and large effort is being made to mitigate it.

298. Graham, W.

Summary of Visual Detection Data Taken During the ATA/CAS Flight Tests.

In: Control Data Corp. Air-to-Air Visual Detection Data. Report FAA-RD-73-40, Part III April 1973 10p. N73-21145

Details of the equipment used and a summary of each flight are given. The geometrical aspects of the flights are analyzed numerically.

299. Graham, W. and Mangulis, V.

Results of an Aircraft Visibility Questionnaire Concerned with the Estimated Benefits of Airborne Proximity Warning Indicator Systems.

Control Data Corporation, Advanced Systems Division Contract DOT-FA70WA-2263 FAA Report RD 75-46 January 1975 152p. AD-A009 884 N75-20961

Gives results of 3,000 questionnaires which were returned from a mailing of 15,000 to pilots whose names were drawn from the Airmen's Directory Tapes. Preferences of pilots for the relative bearing accuracy of PWI displays are reported and for the type of display. The mean time to abandon search failing detection after receipt of a traffic advisory is given for pilots of various classes as is the estimated time required to avoid an impending collision after detection of a threatening aircraft, and the pilot's confidence that he can successfully avoid is reported.

300. Graham, W. and Mangulis, V.

Results of the Visual Detection Simulation Experiments for the Evaluation of Aircraft Pilot Warning Instruments (APWI).

Control Data Corp., Advanced Systems Div. Contract DOT-FA70WA-2263 FAA Report RD 75-59 vol. 2, December 1974 230p. AD-A017 023

Evidence for the validity of simulation, consisting of calibration data and comparisions of detection results obtained in the simulator with real world data from other sources, is reviewed. In the experiment reported APWI systems with sharp range and altitude cut-offs were simulated, and with bearing resolutions of 180, 30 and 2 deg.; part of the experiment was run with no APWI at all for comparison. The results show how the most critical factor in determining the probability of detection of a target is the time available to the pilot for detection.

301. Graham, W., Reed, J. and Meyer, E.

A Visual Detection Simulator (VDS) for Pilot Warning Instrument Evaluation.

AIAA Visual and Motion Simulation Conference, Palo Alto, Calif., September 10-12, 1973. Paper 73-916. 6p.

This simulator has been designed for the specific purpose of producing reproducible visual stimuli which will provide realistic detection ranges, in air-to-air encounters, by pilots who are simulataneously occupied with flying a trainer. Comparison of detection ranges in the simulator with those recorded in actual flight are presented.

302. Greenlee, P.H.

High Intensity Flashing Lights and Collision Avoidance.

SAFE Journal vol. 6, p 12-15, Winter 1976

Intensity requirements for anticollision aircraft lights in both daytime and nighttime conditions are presented by examining such parameters as distance, intensity of light, brightness or luminance of the background against which the lights are viewed, and the transmissivity of the intervening atmosphere. Presently available systems stress a dual red-white system with white lights for daytime operation and red lights for nighttime operation. Hardware concepts developed to meet the dual red-white system are also presented.

303. Ground-Based Collision Avoidance System Under Development.

Aviation Daily vol. 202, no. 39, p. 311, August 25, 1972

A new generation transponder system now under development may lead to a radar-source ground-based collision avoidance system. Called DABS--Discrete Address Beacon System--the work is being directed by MIT Lincoln Laboratories which has contracted with FAA to produce firm specifications for an experimental model by January 1974.

304. Gupta, V.P.

Capacity Impact of Revising Aircraft Categories and Final Approach Separation Standards.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-7183 March 1976 36p.

Recent adoption of a 3-category system for longitudinal separation standards by the U.S. and Canada has led to the possibility of a common position on "aircraft categories and separation standards" between U.S., U.K. and Canada, which eventually may lead to an international agreement on this subject through ICAO. This paper compares the capacity impact of various probable recategorization/separation standards alternatives, in order to help guide the vortex data collection and analysis effort in the most fruitful direction.

305. Gupta, V.P. and Haines, A.

An Advanced Air Traffic Management Concept Based on Extensions of the Upgraded Third Generation ATC System. System B: Discrete Address Beacon System (DABS) Accuracy and Coverage Requirements.

Mitre Corp. Contract DOT-FA70WA-2248 Report EM73-10A-Ser. 5 (MTR-6419-Ser-5) February 1974 63p. AD-785 311 N75-11925

The report develops the DABS system configuration for the AATMS, System B, and evaluates the coverage provided by the resulting 291 DABS sites. The report also develops the IFR spacing standards and the navigation and surveillance requirements sufficient for AATMS, System B, to handle the projected 1995 nominal demand load. Two worst cases have been chosen, the New York to Chicago corridor for the en route case, and the Los Angeles Basin for the terminal case.

306. Habercom, Guy E., Jr.

Collision Avoidance Systems: A Bibliography with Abstracts, 1964 -- August 1977.

National Technical Information Service NTIS/PS-77/0765 September 1977 309p.

This updated bibliography contains 300 abstracts, 221 of which cover air transportation.

307. Hagopian, J. and Morgan, T.

Controller/Computer Interface with an Air-Ground Data Link.

Computer Sciences Corporation and Transportation Systems Center FAA Report RD 76-91 June 1976 150p.

This report describes the results of an experiment for evaluating the controller/computer interface in an ARTS III Metering and Spacing system modified for use with a simulated digital data link and a voice link utilizing a computer-generated voice system.

308. Haines, A.L.

An Analysis of a 2.5 nmi. Final Approach Separation Standard.

Mitre Corporation, METREK Division Contract DOT-FA70WA-2448 Technical Report MTR-7333 June 1977 45p.

For most airports, a 3 nmi. IFR separation standard on final approach governs the majority of aircraft pairings. This paper presents an analysis of some of the feasibility factors of reducing this 3 nmi standard to 2.5 nmi, with today's state of knowledge and ATC facilities. It concludes that (1) the reduction to 2.5 nmi would provide a significant increase in capacity on several runways at some of the major hub airports,

(2) a reduced 2.5 nmi. separation standard may be feasible if wake vortex safety, and operational safety and acceptability can be established.

309. Haines, A.L.

Concepts for Determination of Longitudinal Separation Standards on Final Approach.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-7047 October 1975 41p.

Precise definitions are developed in this paper with a view toward identifying the relationships between separation standards and the variables describing the final approach environment. This provides a basis for systematic evaluation of changes in separation standards due to changes in the environment, particularly through Engineering and Development products. Analytical relationships are developed primarily for IFR conditions, represented by strict adherence to all applicable ATC rules and procedures.

310. Haines, A.L.

Definitional and Analytical Relationships for Longitudinal Separation Standards on Final Approach.

Mitre Corp. Contract DOT-FA70WA-2448 Working Paper WP-11120 July 1975 70p.

This paper presents the definitional and analytical relationships required for the study of longitudinal separation standards on final approach. The structure is given for a model (already operational) to calculate applicable separation standards under a wide variety of conditions, and estimate the associated arrival throughput capacity. A complete example problem is also presented.

311. Haines, A.L., Horowitz, B.M. and Smith, A.P.

A General Model for Separation Standard Assessment.

Mitre Corp. Contract DOT-FA70WA-2448 Technical Report MTR-6909 May 1975 36p

This paper presents the concepts of a General Model for the assessment of separation standards in an Air Traffic Control system. The model provides a logical framework for comparison among more specialized models of particular separation problems.

312. Hansen, John C. et al

Upgraded Third Generation Information Flow Requirements Analysis. Volume I--Summary; Volume II--Analysis; Volume III---Appendices.

Computer Sciences Corp. Contract FA72WA-3072 Report RD 73-65 September 1973 AD 773 434, AD 773 435, AD 773 436/IGA

FAA information transfer requirements are organized into four categories, representing National Aviation System Status, Flight Movement, Flight Planning and Air Traffic Management. The communications requirements are defined and analyzed for the 1975-1985 time frame. Four appendices are included as support to the requirements analysis with Appendix C, entitled 'Collision Avoidance Critical Communication Delay in the Future Terminal Area'.

313. Hanson, James R.

Visual Aspects.

Flight Safety Facts and Analysis vol. 3, no. 11, p. 23, 30, November 1972

Article on visual collision avoidance reprinted by Qantas Flight Ops. *Bulletin. Emphasizes the fact that YOU CANNOT HIT ANYTHING* WHICH HAS MOVED OUT OF THE SPOT FROM WHICH IT WAS FIRST OBSERVED. The moving target attracts attention and so it is not as hard to see, but the stationary target does not attract attention and is the ONLY one where a midair collision results.

314. Harman, C.P. and Jordan, L.

Honeywell, Inc. Customer Engineering Letter to James L. Hinds, Naval Air Development Center, dated April 3, 1974, on the subject: AVOID-I Interrogation and Fruit Rates.

Appendix A to Naval Air Development Center Report No. NADC-75056-60 May 1975 13p.

Results of the study to determine the interrogation and fruit rates to be expected in the L.A. Basin in 1982.

315. Harman, Charles P.

Collision Warning System.

Honeywell, Inc., Government and Aeronautical Products Div. ECOM 0326-F November 1971 45p. AD 890 730L (USGO)

316. Harman, William

Effects of RF Power Deviations on BCAS Link Reliability.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA75WAI-592 FAA Report RD 77-78 (ATC-76) June 7, 1977 34p. AD-A044312

In the design of BCAS there is some freedom in the choice of specifications for BCAS transmitter power and receiver MTL (Minimum Triggering Level). Transmitter power should be high enough to provide adequate link reliability while being low enough to prevent interference problems. The question of providing adequate link reliability for the DABS mode of BCAS is addressed in this study. The study makes use of aircraft antenna gain data resulting from a model measurement program, and is otherwise analytical. It is concluded that appropriate nominal design values are transmitter power =500 watts and receiver MTL=-77 dBm (referred to the BCAS unit). It is shown that these values provide sufficient power margin, at the air-to-air ranges appropriate for BCAS, so as to allow for adverse power deviations that might result from aircraft antenna gains, antenna cabling, and the expected transmitter and receiver deviations due to manufacturing nonuniformities and aging.

317. Harris, James L.

Visual Aspects of Air Collision.

In: Visual Search; symposium conducted at the spring meeting, 1970, Committee on Vision, Division of Behavioral Sciences, National Research Council. Washington, D.C., National Academy of Sciences, 1973. p. 26-50.

The material presented in this paper illustrates a technique of calculation applicable to the air collision problem. No conclusions can be drawn from a single case involving one aircraft, one aspect, one lighting geometry, one search solid angle, or any other single instance of a wide variety of conditions. Similar analysis performed for a cross section of such cases will give insight into the nature of the visual capabilities in air collision avoidance. A clear understanding of the capabilities and limitations of the human visual system in collision avoidance with full recognition of the pilot's cockpit workload is a necessary prerequisite for the development of satisfactory solutions to the problem.

318. Harris, R.M. et al

Advanced Air Traffic Management System B: Summary Report.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM 73-10 (MTR-6419, Series 1) June 1973 243p.

This report summarizes the Mitre study of AATMS System B - extensions of the Upgraded Third Generation ATC System to handle the traffic and provide the services required in 1995. The study examined techniques and costs for alternative ways of building upon the 1982 Baseline ATC System. Two surveillance approaches were examined:

1. Ground-based DABS using Synchro-DABS to integrate communication, navigation, and surveillance functions and provide an optional air-to-air collision avoidance (CAS) capability.
2. Hybrid DABS/Astro-DABS employing ground-based Synchro-DABS in the high density areas and satellite-based DABS (Astro-DABS) to provide national coverage.

The primary recommendation of this study is that the extended Upgraded 3rd employing Synchro-DABS be considered the mainstream design for AATMS. A technically feasible DABS-comparable satellite system has been developed at the conceptual level in Astro-DABS. The Astro-DABS system, through further development may become a cost-effective solution for extending DABS surveillance and data link to the non-hub areas.

319. Harris, R.M. et al

An Advanced Air Traffic Management Concept Based on Extensions of the Upgraded Third Generation ATC System: Summary report.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM-73-10A (MTR-6419, Series 1, Revision 1) March 1974 241p. AD 785 023

The system proposed in this study to handle the traffic and provide the services required in 1995 is composed of extensions of the Upgraded Third Generation ATC System. This study examined techniques and costs for alternative ways of building upon the 1982 Baseline ATC System. Two surveillance approaches were examined: (1) Ground-based DABS extended to Synchro-DABS to integrate communication, navigation, and surveillance functions, provide an optional air-to-air collision avoidance (CAS) capability, and to extend collision avoidance capability outside of surveillance coverage; (2) Hybrid DABS/Astro-DABS employing ground-based DABS in the high density areas and satellite-based DABS (Astro-DABS) to complete national coverage.

AD-A065 368 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 1/2
COLLISION AVOIDANCE: AN ANNOTATED BIBLIOGRAPHY MAY 1972 - NOVEM--ETC(U)
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320. Harris, Richard M. and Holland, Frederick C.

Techniques for Increasing Airport Capacity.

International Air Transport Association 19th Technical Conference, Dublin, October 23-28, 1972. WP-14 17p.

The next ten years will see many changes in airport operations and terminal airspace. Guideline predictions are: reduction in longitudinal spacing from 3 miles to 2 miles, with variable spacing for wake turbulence under some meterological conditions; improved delivery accuracy from $\pm$ 42 seconds interarrival to $\pm$ 10 seconds; Reduced lateral spacing from 5000' to 3500' with present sensors and ARTS III, then to 2500' with DABS and MLS; frequent use of dual-lane runways; separate facilities for general aviation and V/STOL; curved approaches and departures via MLS for noise abatement; and semi-automated ground traffic control.

321. Harrison, R.N.

Oceanic Clearance for the SST.

Interavis vol. 28, p. 340-341, April 1973

Flight requirements and restrictions expected in future trans-oceanic operations of Concorde SST aircraft are used to define the scope of relevant ATC functions and to delineate necessary computer hardware and software for these functions. Attention is given to aircraft separation standards, track allocation considerations, and flight mode (acceleration and cruising) specifications. Design requirements for a computer system are postulated, and categories of data to be processed are discussed along with general aspects of system operation.

322. Haxthausen, Bruce

What's Ahead in the Seventies.

Airline Management vol. 4, no. 6, p. 14-16, July 1972

Discusses CAS and PWI efforts along with other electronic R&D programs to promote ATC safety and capacity.

323. Headley, P.J.

Reduction of Vertical Separation.

International Civil Aviation Organization. Review of the General Concept of Separation Panel (RGCSP) RGCSP-WP/62 Montreal August 1975

324. Heads Up.

Flight Safety Foundation. Inc. Air Taxi/Commuter Safety Bulletin, October 1972. In: Flight Safety Facts and Analysis vol. 3, no 10, p. 18-20, October 1972.

Summarizes the NTSB study, "Special Study of Midair Collisions in U.S. Civil Aviation," 1969-1970.

325. Hector, R.G.

Methods of Auditory Display for Aircraft Collision Avoidance Systems.

In: Aerospace Medical Association, Annual Scientific Meeting, 43rd, Bal Harbour, Fla., May 8-11, 1972 Preprints. p. 240-241

To facilitate visual detection, a head-up, omnidirectional, two-dimensional auditory display is proposed which transforms the elevation information of the intruding aircraft into either the peak tones at the proper pressure ratios, or into high-pass noise shaped into the proper spectrum. It is shown that this display appears to be feasible and that it possesses many advantages that should be considered in developing a cost effective system.

326. Helicopter Multifunction System and Hydrofluidic Control Systems for Helicopters.

In: International-Helicopter Forum, 11th, Buckeburg, West Germany, June 10-12, 1975, Reports. Buckeburg, West Germany, Hubschrauberzentrum, 1975 12p.

A description is given of the capability of an anticollision warning system developed by an American aerospace company for the U.S. Army. The considered system performs as a multifunction transponder system. It will display on demand the range, bearing and altitude information relative to another helicopter/aircraft or to a more simple cooperative remitter station located on the ground or water. Details of the system's development history are discussed along with the system's characteristics. A review of recently conducted flight tests is also presented.

327. Hemesath, N.B. et al

Three and Four Dimensional Area Navigation Study.

Collins Radio Group, Rockwell International Contract DOT-FA72WA-3123 Report RD 74-150 June 1974 214p.

The results of analytical study and real time cockpit simulation of three and four dimensional airborne area navigation concepts for increasing aviation system capacity in the terminal area are presented. Varying degrees of ATC capability, approach and landing aids, and airborne system capability are addressed. Modifications to the FAA metering and spacing algorithms to define ground referenced rather than air referenced flight paths are discussed.

328. Henley, S.G.

Contradictions in Midair Collision Prevention?

Aerospace Safety vol. 31, no. 11, p. 1-4, November 1975

Suggests 8 things for military pilots to use to avoid midairs. Most of them are based on the "see and avoid" concept. The high intensity strobe light is a significantly more effective midair collision avoidance device than the standard rotating beacon.

329. Herbert, John W.

Cockpit Traffic Display.

Flight vol. 61, no. 5, p. 28-29, 33 May 1972

With nearby traffic depicted on his scope, pilot can see what's going on and maneuver accordingly without confusion from ground-based controllers. The ATSD (an Airborne Traffic Situation Display) being tested by M.I.T. Lincoln Lab. makes it possible for the pilot to follow on a cathode ray tube (CRT) his own aircraft's progress and that of nearby air traffic to accomplish more precise navigation, spacing and merging with other traffic. It also has the potential use as a collision avoidance system.

330. Higbie, Thomas E.

Guidelines for the Development of High-Intensity Anti-Collision Strobe Light Systems. Volume III. Development of an EMI Strobe Light Breadboard Model at NAFI. (U)

Naval Avionics Facility Report NAFI-TR-2129 vol. 3, June 30, 1976 216p. AD-B015 943L (USGO)

For vol. I. See, Willenbrock, John C.
II. See, Willenbrock, John C.
IV. See, Wayne, Daniel G.

331. Hinds, J and Shames, O.

Flight Test Evaluation of AVOID I (Avionic Observation of Intruder Danger) Collision Avoidance System.

Naval Air Development Center, Naval Navigation Laboratory Contract DOT-FA73WAI-358 Report NADC-75056-60 May 1975 334p. AD-A011 449 N76-10083

AVOID is a candidate for a national standard collision avoidance system. A comprehensive flight and laboratory evaluation of the AVOID I version was conducted including the ability to communicate accurately and with sufficient distance to provide timely and correct advisories and maneuver commands in simulated high traffic density. Appendices contain computer printouts for various tests.

332. Hinds, James L., Raditz, Michael G. and Shames, Oscar.

Navy Flight Experiment of SECANT Transponder Correlation Ranging Equipment.

Naval Air Development Center Final Report NADC-72112-AE July 27, 1972 70p. AD 746 448 N73-11416

Flight tests of portions of an airborne collision avoidance system designated as SECANT were conducted. The feasibility of a random sequence binary correlator, digital range and range rate tracker was established. Further testing of a complete system is recommended.

333. Hinson, Roscoe McClendon, Jr.

A Collision Avoidance Warning Criterion for Maneuvering Aircraft. PH.D. Thesis. Georgia Institute of Technology. 1972 99p. N73-21915 Univ. Microfilm Order No. 72-26306

The purpose of this research was to develop a warning criterion suitable for areas where the aircraft densities are high and where aircraft maneuvers occur frequently. The aircraft flight paths were considered to be stochastic processes and the warning criterion was therefore based on the probability of a collision.

334. Holland, Frederick C., Rucker, Richard A. and Horowitz, Barry M.

Structure of the Airspace.

IEEE Trans. Vol COM-21, no. 5, p. 382-398, May 1973

The paper provides an overview of the current airspace structure, describes some of the new concepts to be implemented over the next ten years, describes the expected airspace structure to be introduced in the 1980's, compares alternative control concepts, and estimates the air/ground data link requirements needed to support the traffic densities anticipated in the Los Angeles basin in 1995. Discusses the various means of separation of aircraft, IPC, DABS, Area Navigation, and MLS.

335. Holt, J.M. and Hamilton, R.H.

Surveillance Velocity Measurements with Least Maximum Error.

Navigation vol. 21, p. 351-356, Winter 1974-1975

The surveillance/separation assurance function used for automated air traffic control to insure safety on near parallel airways is optimized by deriving the best possible compromise between noise and acceleration-induced errors as a function of measurement accuracy, acceleration magnitude and sampling frequency. It is found that an error allowance of 30 kt would be adequate with 97.7% confidence, provided 58 position measurements spaced 0.1 sec apart were available. Very fine measurements are thus required to obtain small speed measurement allowances, so that it is presently not possible to achieve separation standards through surveillance measured speed only. As sampling frequency is increased, the assumption of independent measurement errors becomes tenuous.

336. Holt, J.M. and Watson, F.D.

Synchronization Station Location Study: Summary.

McDonnell Douglas Electronics Co. Contract DOT-FA73WA-3172 FAA Report RD74-120 July 1974 108p. AD-A032 742

A technology for evaluating ground station sites on the basis of their effectiveness in disseminating time synchronization has been produced. Computational capabilities developed during this study include the ability to model total CONUS aircraft population activity as a three-dimensional time variant and to model scheduled aircarrier operations. For a given day and time-of-day, the altitude, latitude and longitude of each aircarrrier is computed. Then, air-to-air and air-to-ground communication linkages are determined.

337. Holt, J.M. and Watson, F.D.

Synchronization Station Location Study: Tradeoff Phase.

McDonnell Douglas Electronics Co. Contract DOT-FA73WA-3172
Report RD74-117 May 1974 77p. AD-785 335 N74-34155

Techniques have been developed and applied in making trade-off evaluations of the overall synchronization effectiveness of various levels of airborne vs. ground-based hierarchal time relaying equipage. NTSB records of aircraft collisions indicated that a high level of coverage could be supplied by five master stations complemented by larger aircarrier equipped with hierachal equipment.

338. Holt, J.M., Watson, F.D. and Neumann, C.J.

Synchronization Station Location Study: Calibration Study Phase.

McDonnell Douglas Electronics Co. Contract DOT-FA73WA-3172 FAA Report RD 73-173 October 1973 150p. AD 779 538 N75-12925

The calibration phase of this contract reported here validates critical and sensitive aspects of the methodology and provides the basis for selecting and executing particular trade-off analyses. Several non-heirarchal aircraft population models and several measures of system effectiveness were investigated. The conclusion is reached that a set of master station sites can be selected which obtain very high levels of all examined effectiveness measures when servicing the foreseeable population of non-heirarchal aircraft.

339. Holt, J.M., Watson, F.D. and Neumann, C.J.

Synchronization Station Location Study: Methodology Development.

McDonnell Douglas Electronics Co. Phase I Final report Contract DOT-FA73WA-3172 Report RD 73-102 July 1973 219p. AD 768 677

The purpose of this contract was to determine siting criteria and installation priority for deployment of ground stations that provide precision time service to NAS. An analytic quantification of performance of hierarchal time/communications systems is provided as the basis for evaluating time distribution capabilities.

340. Holt, John M.

Safe Separation in Controlled Flight.

Navigation vol. 21, no. 1, p. 1-8, Spring 1974

This paper examines the consequences of the point of view that separations must be adequate for ATC to provide effective, essentially redundant, protection against blunders or failures aboard the aircraft.

341. Honeywell Airborne Collision Avoidance System Gets Highest Marks.

Aviation Daily August 17, 1976 p. 263

A recently released FAA report said that both of Honeywell's systems for commercial and general aviation aircraft were superior in all technical areas and least expensive in five major areas as compared with McDonnell Douglas and RCA systems. The Honeywell system also scored highest in range rate accuracy and degree of design maturity.

342. Honeywell, RCA In CAS R&D Race.

AOPA Pilot vol. 16, no. 4, p. 31, April 1973

Honeywell's AVOIDS system and RCA's SECANT system are both cooperative information-exchanging systems, but both offer some possibilities for general aviation.

343. Honeywell Says Its Collision Avoidance System Ready For Airline Use.

Aviation Daily p. 237, December 15, 1975.

Honeywell said it has successfully tested an airborne collision avoidance system that could be installed in commercial aircraft for about $10,000 but that FAA probably will not go along with that type of warning device. Tests on Honeywell's system, which is based on pulsed, coded radar signals were conducted by the Naval Air Development System, the Institute for Defense Analyses and ARINC Research Inc., which did the cost analysis.

344. Honeywell's Answer to Collision Warning.

AOPA Pilot vol. 15, no. 6, p. 56-57, June 1972

Honeywell's Collision Warning System (CWS) is designed to alarm whenever an intruding aircraft is within 300 feet of the subject aircraft and computation of Tau (time to collision) is less than 15 seconds. To take care of very slow closure rates, an additional warning is given when two aircraft are within 1,000 feet of each other, regardless of rate of closure. It is designed to tell whether the intruder is above, below, or level.

345. Honeywell's CAS Seeks Way Around High Costs.

Electronics vol. 45, no. 12, p. 35, June 5, 1972

AVOIDS (Avionics Observation of Intruder Danger Systems) the new CAS is derived from proximity warning indicators developed at Fort Rucker, Ala., for Army helicopters.

346. Hopkin, V.D.

Human Factors Problems in Conflict Detection and Resolution.

In: AGARD CP-105 Air Traffic Control Systems. Papers presented at the 14th Meeting of the Guidance and Control Panel of AGARD held in Edinburgh, Scotland, 26-29 June 1972. Paper 25-1 to 25-6.

It is commonly assumed that conflict detection and resolution pose similar human factors problems whenever they occur in ATC. In this paper, it is contended that this assumption is probably incorrect, primarily because of the large differences in urgency, information, procedures and facilities in various phases of flight. The controller's responses depend on the confidence he has in the data available to him, and on his knowledge of how accurate it is likely to be.

347. Hopkin, V.D.

Some Effects of SST and General Aviation Traffic on Controller Capacity.

The Controller vol. 14, p. 24, 25, 28-31 August 1975

Effects common to both SST and general aviation traffic are examined. A description of the potential effects of SST operations on controller capacity takes into account perceptual judgments, the provision and use of information, the depiction of SST aircraft, automated aids, and the solutions which may be adopted in resolving potential conflicts affecting SST aircraft.

348. Horowitz, B.M.

A Recommended Test Concept of IPC Flight Tests Using DABSEF.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6699 August 1974 20p.

This paper presents a recommended test concept for the IPC flight tests to be conducted at the DABSEF by Lincoln Laboratories. The concept is based on Mitre's experience in working with the IPC system and is oriented towards answering the human factors questions which can only be addressed by flight test, and to substantiating the results of IPC fast-time simulation studies conducted by Mitre.

349. Horowitz, Barry M.

The ACAS Desensitization Problem and a Possible Approach to Desensitization.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-7021 September 1975 25p.

This paper presents a discussion of the Airborne Collision Avoidance System desensitization problem. Recommendations are presented on a possible approach to make ACAS workable in the current ATC environment. The recommended approach would require significant modifications to the current ACAS design, both in terms of collision avoidance logic and in terms of information received and transmitted by aircraft. The approach uses pilot input switches to help define situations which require special ACAS treatment.

350. Horowitz, Seymour M.

An Evaluation of the ARTS III Level of Automation (Third Lot Procurement).

FAA, Office of Aviation Economics Final Report July 1972 158p.

The evaluation was made by simulating the air traffic environment in a statistically balanced experimental setting. There was, as expected, a reduction in midair collisions.

351. Horton, W.F. and Bowers, A.W.

Conflict Prediction Design for the Automated IFR Traffic Control (AITC) Program.

Mitre Corporation Contract DOT-FA70WA-2448 Working Paper WP-11108 May 1975 126p.

The requirements for coding a conflict prediction module to be included in an automated system simulation capable for generating ATC clearances to IFR traffic flying through an arbitrary en route environment are described. The conflict prediction algorithm is general purpose in that it detects conflicts within N nautical miles and H feet in altitude. It further specifies the amount of airspace denied to each aircraft due to the presence of others. All aircraft are assumed to be following filed IFR flight plans.

352. Horton, William F., Jr.

Conflict Prediction Theory for Automated IFR Traffic Control.

Mitre Corporation Contract FA70WA-2448 Working Paper WP-10911 January 1975 84p.

This paper develops a model to predict conflicts between aircraft based upon flight plan data and a description of the airspace region within which conflicts may occur. It is assumed that the conflict prediction capability is a part of an automated IFR traffic control system, resident in a computer, that must plan conflict-free clearances for all controlled (IFR) aircraft.

353. House Committee Concerned About Military-Civilian Midair Collisions.

Aviation Daily May 26, 1976 p. 141.

House Government Operations Committee has said there is "a serious danger" of midair collisions between military and civilian aircraft in certain offshore areas. They recommend that the FAA and the Navy establish Fleet Area Control and Surveillance Facilities wherever there is a volume of military aircraft using offshore warning areas for training exercises.

354. Howell, Jack D.

Simulator Evaluation of Pilot Assurance Derived from an Airborne Traffic Situation Display.

Massachusetts Institute of Technology, Electronic Systems Laboratory, Flight Transportation Laboratory and Man-Vehicle Laboratory Contract FA71WAI-234 FAA Report EM72-3 February 1972 164p. AD 749 280

An extensive series of tests were run on a transport cockpit simulation facility to evaluate the pilot assurance value of airborne displays used as traffic situation monitors in high-density terminal airspace. The twenty professional pilots employed as subjects were exposed to a set of typical normal and abnormal terminal approach situations. Their level of assurance was determined from their detailed knowledge of each situation, measured by stop-action quizzes, and the ability to detect conflicts.

Pilot assurance was found to increase markedly when a traffic situation display was available. The display more than compensated for the loss of voice party-line information when the discrete address command mode was in effect. The acquisition and retention of information also became much more selective with the display, focusing on such critical items as the relative position of nearby aircraft. The detection of malfunctions and blunders improved greatly, although single test subjects simultaneously performing the inner loop tasks of flying the aircraft, spacing themselves precisely in trail, and tracking the ILS beam did not detect all conflicts.

355. Huang, S.C. and Joshi, A.

The Automatic Aircraft Guidance Law for Midair Collision Avoidance.

In: International Conference on Cybernetics and Society, Boston, Mass., November 5-7, 1973, Proceedings. New York, IEEE, 1973. p. 133-138

This paper gives the automatic optimal guidance law and the guided optimal trajectories for two aircraft to avoid midair collision in the terminal area. The paper consists of two parts. The first part formulates the two aircraft collision problem into the framework of control theory. In the second part, the maximum principle is used to obtain a numerical procedure. Two cases of head-on collision were simulated by a computer APL Program.

356. Huffman, John B.

ATC Rules--A letter to the editor.

Aviation Week & Space Technology vol. 102, no. 19, p. 62, May 12, 1975

Suggests that the avionics capabilities of the military fleet be brought up to the point that it would interface with the present ATC system. Military pilots are advocates of the see-and-avoid principle also.

357. Hulland, Burton,

Simulation of Tri-Model BCAS Operations in Very High Density Air Traffic.

Hulland Engineering February 1977 38p.

Hulland is a member of the Litchford Electronics Design Team for FAA's BCAS Air-Derived Separation Assurance Program. This report states that contrary to some predictions, the Tri-Modal BCAS will operate satisfactorily in very dense air traffic. Results of computer simulations indicate that a pilot flying a BCAS-equipped aircraft can be provided information to avoid 99+ percent of all collision threats encountered during his flight in the most dense air traffic postulated by the FAA.

358. Human Failure Led to Near Collisions, NTSB Says.

Aviation Daily April 2, 1976 p. 196

In four recent near midair collisions human failure by air traffic controllers were 'critical causal factors' NTSB

In four recent near midair collisions human failure by air traffic controllers were 'critical causal factors'. NTSB recommends action by FAA to reduce chances of human failure should include changes in procedures, training, supervision, performance monitoring, and selection standards, or by providing increased redundancy in the man-machine relationship.

359. Hunter, J. Stuart

Statistical Methods for the Estimation of Aircraft Collision Risk.

Princeton University Contract DOT-FA72NA-741 July 1976 104p.

A problem in the estimation of aircraft collision risk for a parallel-track air traffic system is formulated in terms of the "lateral overlap integral", a function of the distribution of lateral deviations from course. Several statistical methods are developed or modified for the purpose of estimating the lateral overlap integral based on a random sample from the lateral deviation distribution. Results of particular interest are new inequalities in the theory of distributions, used to obtain bounds on the collision risk, and novel approximate methods for variance estimation.

360. Hurd, Willis F. (Consultant)

Airborne-Proximity-Warning Indicator Visual Display for Preliminary Design Simulation.

Mitre Corp. Contract DOT-FA70WA-2448 Report MTR-6588 February 6, 1974 50p.

This report describes a technically feasible approach for the display and image generation subsystems for a general aviation flight simulator as used in the FAA's Airborne Proximity Warning Indicator program. A critical requirement is the specified resolution goal of one minute of arc. This value, reconfirmed by FAA requirements analysis, results in a large and expensive display system -- but one which is feasible in an engineering sense.

361. IATA Concerned About Air Traffic Control Restrictions.

IATA News No. 9, June 8, 1972 3p.

IATA lists 10 basic principles which should be followed by all modern air traffic control organizations in meeting the imperative requirements of the world air transport industry in the interests of safety, efficiency and punctuality.

362. In-Flight Collision.

AOPA Pilot vol. 15, no. 7, p.67-69, July 1972

Collision between a Piper Comanche and a Bellanca Viking near Phoenix, Arizona. Probable cause of the collision, according to the NTSB, was the failure of each pilot to see and avoid the other aircraft in December 1971.

363. Intermittent Positive Control Plan Changed.

Aviation Week & Space Technology vol. 106, no. 19, p. 57, May 9, 1977

As a result of flight tests at Lincoln Lab., the FAA now plans to limit the service to alerting the VFR pilot to other aircraft in the vicinity and displaying their approximate positions in azimuth and relative altitude -- thus "automated traffic advisory service".

364. International Civil Aviation Organization

Mathematical Methods Relating to the Vertical Separation Problem.

Circular 106-AN/80 1972 59p.

Discusses separation under the "geometric distance" hypothesis, collision risk, and summarizes the work of the Vertical Separation Panel.

365. International Civil Aviation Organization

Methodology for the Deviation of Separation Minima Applied to the Spacing Between Parallel Tracks In ATS Route Structures.

Circular 120-AN/89 1974 196p.

This circular consists of material extracted from the documentation presented at the second meeting of the "Review of the General Concept of Separation" Panel, held in Montreal 2--19 October 1973.

366. International Civil Aviation Organization

Report of the Ninth Air Navigation Conference

Doc. 9168, AN-CONF/9 1976 var. pp.

Agenda Item 1: Separation between aircraft:

(a) Review of studies and proposals relating to separation between aircraft in respect of:
- principles and methods to be applied in determining separation minima;
- lateral separation, with particular reference to the spacing between parallel tracks in ATS route structures based on VOR or VOR/DME facilities;
- longitudinal separation, including separation between aircraft arriving at and departing from aerodromes when wake turbulence is suspected or known to exist;
- radar separation, with particular reference to the use of processed radar data;
and further development of the specifications and/or guidance material to the extent possible.

(b) Review of the results of studies regarding the feasibility of reducing the vertical separation minimum above FL 290 and determination of further measures to be taken to facilitate such reduction.

367. International Civil Aviation Organization

Review of the General Concept of Separation Panel, Second Meeting, 2--19 October 1973 Report.

Doc. 9089 RGCSP/2 (1973) 1974 79p.

Recommendations included:

a. Methodology for the derivation of separation minima applied to the spacing between parallel tracks in ATS route structure.
b. Guidance to assist states in planning the lateral spacing between parallel tracks in ATS route structure.
c. Time keeping accuracy in ATC and on board aircraft.

368. International Civil Aviation Organization

Summary of the Eighth Meeting of the North Atlantic System Planning Group (NAT/SPG), 15 to 21 February 1972, Paris, France.

ICAO Letter T 17/1.1 N 0 0272 March 1, 1972 44p.

Item 2 of the Agenda dealt with "the use of composite separation in the NAT Region and those problems in the adjacent transition areas resulting therefrom."

369. International Civil Aviation Organization

Systems for Collision Avoidance.

Doc. 9004 AN-Conf/7 Report of the Seventh Air Navigation Conference, Montreal 5-28 April 1972 p. 7-1 -- 7-6

The Appendix lists Guidance Material Relating to Design Features and Operational Characteristics of Airborne Collision Avoidance Systems (ACAS) and Airborne Proximity Warning Indicators (APWI).

370. International Civil Aviation Organization

Visual Aids Panel; Sixth Meeting, Montreal, 6-17 March 1972.

Doc. 9005, VAP/VI (1972) Agenda Item 4. Navigation and Anti-collision Lights. 18p.

371. Israel, D.R.

Collision Avoidance Systems.

In: Upgrading the ATC System; Proceedings of the R.T.C.A. Annual Meeting, Washington, D.C., November 28, 29, 1973. Radio Technical Commission for Aeronautics, 1973. 20p.

The positions which the principal users of the air traffic control system have taken with respect to collision avoidance systems are discussed.

372. Israel, D.R.

A Discrete Address Beacon System.

In: International Telemetering Conference, Washington, D.C., October 9-11, 1973, Proceedings. Pittsburgh, Pa., Instrument Society of America, 1973. p. 1-11

This paper outlines the present FAA program to develop a new surveillance system which will eliminate the problems of the ATCRBS system, will be compatible with the existing system, and will also provide a digital data-link for collision avoidance and air traffic control purposes.

373. Israel, D.R.

An Overview of the Upgraded Third Generation Air Traffic Control System.

In: EASCON '74: Electronics and Aerospace Systems Convention, Washington, D.C., October 7-9, 1974, Record. N.Y., IEEE, 1974, p. 244-249

With the continuing growth of aviation, improvements to our current air traffic control system will be required. The system planned for use in the 1980s and beyond is now known as the Upgraded Third Generation System (UG3RD). It is designed to meet the FAA's goals of: (1) maintaining or improving

safety, (2) constraining or reducing costs, and (3) increasing or improving performance. The system will be characterized by nine major features -- Intermittent Positive Control (IPC), the Discrete Address Beacon System (DABS), Area Navigation (RNAV), Microwave Landing System (MLS), Increased Automation, Airport Surface Traffic Control (ASTC), a Wake Vortex Avoidance System (WVAS), Flight Service Stations (FSS), and Aeronautical Satellites (AEROSAT).

374. Israel, David R.

Air Traffic Control: Upgrading the Third Generation.

Technology Review vol. 77, p 14-24, January 1975

The national air traffic control system's primary functions are control, navigation, surveillance, and communications. Planning and development of air traffic control must consider the needs of the operators and users of the system, the system's goals (improved performance, improved safety, and reduced costs), and factors such as economic and environmental constraints. An upgraded third generation system for the 1980s and 1990s is judged to be superior to either a fourth-generation Advanced Air Traffic Management System (AATMS), which would involve a series of space satellites, or a distributed-management concept, which would transfer air traffic control to the cockpit. The nine key features of the upgraded third-generation system are: Intermittent positive control to prevent midair collisions, a discrete address beacon system, area navigation, a microwave landing system, increased automation, airport surface traffic control, the wake vortex avoidance system, automated flight service stations, and aeronautical satellites for transocean flights.

375. Israel, David R.

Collision Avoidance Systems.

Journal of ATC vol. 16, no. 2, p. 7-11, March-April 1974

Paper given at the 1973 RTCA Annual Assembly. The FAA is firmly committed to the premise that the ground-based ATC system is, and will be for the foreseeable future, the primary collision avoidance system of the U.S. However, the agency recognizes the responsibility to investigate, evaluate and implement all techniques for preventing collisions providing that they enhance overall system safety, are compatible with the ground-based ATC system, are in the interest of airspace users, and can be made economically attractive to the users. The FAA will investigate and test all air-derived separation assurance systems which meet the criteria above, and will report the results to Congress.

376. Israel, David R.

Key Features of the Upgraded Third Generation Air Traffic Control System of the Federal Aviation Administration.

In: Handling the Air Traffic of the Long-Term Future: 19th Technical Conference, International Air Transport Association, Dublin, October 23-28, 1972. Montreal, Canada, IATA, 1973? WP-28 17p.

This paper discusses the principal new features and associated FAA programs directed toward the upgraded third generation ATC system planned for the United States, including intermittent positive control, the discrete address beacon system (DABS), collision avoidance, automation, wake vortex detection, surface surveillance and control, and oceanic satellities.

377. Israel, David R.

Response to Congressman Goldwater.

Journal of ATC vol. 16, no. 2, p. 15, March-April 1974

Comments on the paper given by Goldwater at the RTCA Annual Assembly.

378. Israel, David R. et al

Rationale for Improving the Protection Against Midair Collisions.

FAA, Associate Administrator for Engineering & Development FAA Report AED 75-1 December 1975 2 vols. AD-A023 810 AD-A024 544 N76-28205 N76-29186

This document summarizes the findings, conclusions and recommendations of a working group established to consider the pertinent data, analyses, tests, and other factors bearing on possible methods and techniques for preventing midair collisions.

379. Jensen, Walter

Statement of the Vice President, Operations, Air Transport Association Washington, D.C.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 178-189.

He stated that ATA believe that the establishment of a mandatory date for the use of CAS and PWI should be a matter of FAA

rulemaking and not an action of the Congress. For that reason they think it would be unwise to pass S.2264. A copy of his full statement with Attachment A -- Chronology of the Airline Search for a Collision Avoidance System; and Attachment B -- Fact Sheet -- Collision Avoidance System Fundamentals are included.

380. Jerome, E.A.

CAS: What Pilots Can Expect.

Flight Operations vol. 65, no. 6, p. 22-23, 26-28, 40, June 1976

For midair separation assurance, FAA has selected beacon collision avoidance systems (BCAS) using existing ATC radar beacon system elements. But this is only part of the five-point program: (1) Conflict alert now in use, (2) new flight plan requirements, (3) transponder equipment for all aircraft in certain controlled airspace, (4) development of BCAS, and (5) development of intermittent positive control. Reviews various organizations' opinions.

381. Jerome, E.A.

Those Critical Three Seconds.

Flight Operations vol. 65, no. 5, p. 34-35, 38, 47, May 1976

Review of the near-miss between the DC10 and L-1011 over Carleton, Michigan. The author states this incident is a good case for 'conflict alert' -- and a lesson alerting ATC to the catastrophic potential of controller distraction.

382. Johnson, Charles Robert

Control of Air Traffic by Aid of Satellites.

California University Ph.D Thesis 1973 223p. Univ. Microfilms Order No. 73-13147

The feasibility of a system of satellites for monitoring and controlling air traffic on an intercontinental scale is analyzed. Satellies are essentially global in coverage and hence could establish the control of air traffic on a real-time, inter-continental macro-scale basis. This multi-dimensional problem concerns the paths of many types of aircraft, departing, in normal flight and in landing. The several satellite-system models that will need to be designed and flown for various stages of the overall program are described.

383. Johnson, D.B.

Impact of New Separation Standards.

In: What Impacts ATC; Proceedings of the Eighteenth Annual Meeting and Technical Program, Miami Beach, Fla., October 15-18, 1973. Washington, D.C., Air Traffic Control Association, Inc., 1974. p. 36, 37

The significance of new separation standards as seen from a pilot's point of view is considered. It is recommended that a complete evaluation of all factors including future developments should be conducted before a regulatory agency imposes new separation standards. Attention is given to the terminal control area, separation standards for heavy jets, problems of severe weather avoidance and holding patterns.

384. Johnson, George B.

The Case for a Transponding CAS Using Complex Correlation.

ICAO Bulletin vol. 28, no. 11, p. 32--35, November 1973

Describes the RCA system SECANT, which is designed to be compatible within the entire aviation community.

385. Johnstad, Errol L.

Statement of the President, Flight Engineers' International Association, Washington, D.C.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress. Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 168-169

He describes near-misses at the Berlin control zone and states that the McDonnell system EROS worked in 1966 as he was one of their test pilots. He believes that there has been entirely too much procrastination in selecting a CAS system. The association is in favor of Senator Moss' bill S.2264.

386. Johnston, T.M.

Reducing the Threat of Midair Collisions.

Intersociety Conference on Transportation, 2nd, Denver, Colo., September 23-27, 1973, ASME Paper 73-ICT-49. 7p.

A much discussed but poorly understood problem, associated with air travel, is the threat of midair collision by the ever-increasing number of planes utilizing the air space over the United States. This problem is put in the proper perspective, and current efforts by Government and industry to advance the state-of-the-art in collision avoidance systems and to develop a timely solution to the midair collision problem are discussed.

387. Jolitz, G.

Air Traffic Control/Collision Avoidance System Interface Simulation - Phase II.

FAA, National Aviation Facilities Experimental Center Project No. 052-241-050 Report RD73-140 (NA-73-400) November 1973 193p. AD 771 185 N74-12361

Objectives of the Phase II simulation were threefold: (1) to investigate the impact on ATC when the preemptive CAS diverted an equipped aircraft into an encounter with an unequipped aircraft, (2) to investigate the effectiveness of a strategy for switching the CAS threat detection from full system mode to landing mode, and (3) to explore the three-way interface between a proposed general aviation version of the CAS, the commercial CAS and the ATC system.

388. Jolitz, Gordon

ATC/Airborne CAS Compatibility -- An Analysis of Field-Derived Data.

FAA, NAFEC Project no. 052-241-030 Report RD 75-228 (NA 76-14) June 1976 70p. AD-A026 070 N76-30188

Two realtime simulation experiments were conducted at NAFEC for the purpose of investigating the interface between the ATC system and a proposed Airborne CAS. It was concluded that: (1) Some means of desensitizing the ACAS in the final approach sequencing and spacing zone of busy terminal areas was mandatory, and (2) The concentration of ATC/ACAS interaction would probably vary from site to site.

389. Jolitz, Gordon D.

Problems Related to the Measurement and Evaluation of ATC/CAS Interaction.

Paper presented at the 1972 Joint Conference of ORSA, TIMS and AIIE. 13p.

A real-time closed loop simulation was conducted at NAFEC for the purpose of finding order-of-magnitude interaction effects between the air traffic control system and an airborne collision avoidance system. The simulated environment was a high density terminal area with provisions for simultaneous parallel approaches. The CAS was modeled after the threat evaluation and avoidance logic as developed by an industry Technical Working Group under the auspices of the Air Transport Association of America. The simulation was conducted on NAFEC's newly developed digital simulation facility (DSF) which permitted software modelling of the threat detection, threat evaluation and pilot response functions of the CAS. Since the amount and nature of the ATC/CAS interaction would be directly related to the behavior of aircraft, relative to each other, while under ATC, it became of paramount importance to capture the kinematic characteristics of the several experimental conditions.

390. Jones, Richard B. and Lutze, Frederick H., Jr.

Computer Simulation of Near Midair Collisions in the Terminal Environment.

Journal of Aircraft vol. 11, no. 8, p. 457--459 August 1974

A computer simulation model of NMAC's in a terminal environment is developed and its capability demonstrated in a simplified case. The motion of several aircraft is described with certain constraints imposed on the speed, flight path, and other parameters to restrict the aircraft movement to lie within actual operating limitations. The main purpose of this study was to test the feasibility of the approach as far as general complexity, computer execution time, and accuracy. The results indicate good agreement with applicable theoretical arguments as well as additional information relating frequency and severity of near midair collisions to miss distance and aircraft density. Also, the advantage of the computer simulation technique is discussed.

391. Jones, S.R., et al

Study of Alternative Beacon Based Surveillance and Data Link Systems.

Mitre Corporation Contract DOT-FA70WA-2448 Report FAA-EM-74-7 (MTR-6517) March 1974 2 vols. AD-776 676 AD-778 136 N74-34148 N75-17325

Several beacon-based surveillance systems--both addressed and non-addressed--as well as several data link systems, in appropriate combinations, were analyzed with respect to meeting the

future requirements of the Upgraded Third Generation ATC System. These requirements included surveillance characteristics suitable for automatic ground--based collision avoidance (IPC); they also included data link characteristics suitable for delivering all ATC and IPC services and estimated company digital communication services. The Discrete Address Beacon System (DABS) is shown to be the lowest cost of all alternatives for implementing IPC for the basic general aviation user.

392. Karmarker, J.S. and Merz, A.W.

Realization of a Horizontal Collision Avoidance System.

In: Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings. New York, IEEE, 1973. p. 457-461.

Horizontal aircraft collision avoidance maneuvers are examined, along with the associated computer requirements. It is shown that analytical methods can be used to specify the turn maneuvers when the dynamic model of the relative motion includes both speeds and both maximum turn rates as arbitrary parameters.

393. Kassebohm, W.

Flight Safety Problems from the Point of View of the Air Traffic Controller.

Deutsche Gesellschaft fur Luft- und Raumfahrt, Symposium uber Flugbetrieb, Cologne, West Germany, September 15, 1972 Paper 72-038 7p. In German

The particular characteristics of the airspace of West Germany with its very small extension in the east-west direction in comparison to the north-south extension have to be taken into account in an evaluation of the flight safety problems there. Collision risks due to the dense air traffic are examined. It is pointed out that any significant improvement in safety would require a basic reform with regard to the airspace structure and the rules of the air law. The creation of a central agency for the necessary planning involved in such a reform is proposed.

394. Kay, Irwin W.

A Midair Collision Threat Algorithm that Uses Bearing Data.

Institute for Defense Analyses, Science and Technology Division Final Report No. IDA/HQ-76-18690 November 1976 55p. AD-A033 617 N77-23075

This paper derives an algorithm for use by an airborne midair collision avoidance system to determine when an alarm would be given in case a midair collision is imminent. The algorithm is based on an extension of the standard modified tau alarm criterion used in most collision avoidance system threat logics. The standard criterion uses only altitude and range data and, as a result, will generate high alarm rates in heavy air traffic. The criterion presented here makes use of bearing data as well as altitude and range data and should, therefore, provide lower alarm rates. (Author)

395. Keblawi, F.S.

Preliminary Evaluation of Oceanic Cost Penalty Models.

Mitre Corporation Contract DOT-FA70WA-2448 Technical report MTR-6689 July 1974 90p

This document presents a preliminary evaluation of mathematical techniques for estimating the cost penalties associated with separation standards used in oceanic track systems. Emphasis is given to subsonic flights in the North Atlantic Traffic region. The mathematical model used by the North Atlantic System Planning Group (NAT/SPG) was selected as the most comprehensive and suitable of the models analyzed. Specific recommendations were made for augmenting and refining the NAT/SPG model for future use. Using the model with data reflecting 1974 conditions, cost and fuel penalties were computed for today's traffic as well as for future subsonic traffic levels.

396. Keblawi, F.S. and Smith, A.P.

An Annotated Bibliography of Literature Related to Oceanic ATC Collision Safety and Cost/Benefits.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6720 July 1974 172p.

This bibliography lists the work performed since the advent of jet transports which dealt with collision safety and cost/benefits of oceanic and related route structures.

397. Kerstein, Alan Robert

Statistical Methods for the Estimation of Aircraft Collision Risk.

Princeton University. Ph.D. Thesis 1975 143p. Univ. Microfilms Order No. 76-25111

The estimation of aircraft collision risk for a parallel track air traffic system is formulated in terms of the lateral overlap integral, a function of the distribution of lateral deviations from course. Several statistical methods are developed or modified for the purpose of estimating the lateral overlap integral based on a random sample from the lateral devision distribution. Both nonparametric and parametric methods are proposed, and their statistical properties are evaluated through data analysis as well as theoretical examination. Results of particular interest are new inequalities in the theory of distributions, used to obtain bounds on the collision risk, and novel approximate methods for variance estimation. Dissert. Abstr.

398. Khambata, Adi J.

Automation in Air Traffic Control Systems.

In: AGARD A Survey of Modern Air Traffic Control. AGARD-AG-209 Vol. 1 p. 175-198 (1975) N75-32047

Controlling the ever-increasing number of aircraft movements in an orderly and safe manner in the nation's airspace is becoming a problem. The historical evolution is traced of ATC since before World War II. It also discusses the current ATC problems. Collision avoidance is among the areas of automation discussed.

399. Kimball, K.A., et al

Differential Velocity and Time Prediction of Motion.

Army Aeromedical Research Lab. Report No. USAARL 72-14 April 1972 34p. AD-745 119
Perceptual and Motor Skills Vol. 36, pt. 1, p. 935-945, June 1973

This investigation examined the effects of differential target velocity, horizontal or vertical plane conditions, and air traffic controller experience on the estimation accuracy of intersection time of two converging targets. Performance accuracy on this task was not significantly affected by horizontal or vertical conditions or by air traffic controllers' experience.

400. King, J.K.

Air Safety As Seen from the Tower.

IEEE Spectrum vol. 12, p. 67-71, August 1975

The proposal is made to implement a computerized airborne collision avoidance system which is pilot-monitored, aircraft contained, and independent of ground control. It is pointed out that the continued reliance upon a ground-based controller-monitored system is leading inevitably to reduced safety and efficiency, and less orderly regulation in the movement of air traffic in the U.S. The factors against ground-controlled ATC are examined and a detailed analysis of the adverse elements is conducted.

401. King, John K.

Notes from the Executive Director, ATCA.

ATCA Bulletin no. 74-2 p.3, February 1974

States that CAS should be one which contributes most to the saving of time, money and worry, whether its located up there or down here. And certainly preservation of a ground-based controller-manned system should not be a criterion upon which research is based -- if anyone is so inclined.

402. Kirkendall, N.J.

A Review of RGCSP Work on the Determination of Lateral Separation Standards.

Mitre Corporation Contract DOT-FA70WA-2448 Paper M76-8 April 1976 51p.

This document contains the two papers presented to the ICAO 9th Air Navigation Conference in the spring of 1976.

403. Kirkendall, N.J.

Review of the Working Papers of Working Group "C" of the RGCSP on Lateral Separation Standards in European En Route Areas.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6882 August 1975 131p.

Work of Working Group 'C' has been extensive especially in evaluating lateral separation standards for parallel routes in the en route areas when surveillance is in effect. The method used has been a collision risk analysis based on data collected in France and estimated traffic densities on the busy routes in Europe. As a result of this analysis Working Group 'C' has proposed that the RGCSP recommend changes to ICAO Annex 10 and PANS RAC. They are:

1) Determination of protected airspace for single routes by using the observed distribution of lateral deviations from the data collected in France.
2) Establishing that the minimum separation between closely spaced or parallel routes in the en route areas when surveillance is not in effect should be 18 nmi.
"While the methodology is interesting and could lead to a standard approach Working Group 'C" results as they now stand are not in a complete enough state to be considered as a world wide standard."

404. Kirkwood, T.F. et al

Some User Benefits Achievable from an Advanced Air Traffic Management System.

Rand Corp. Contract DOT-TSC-344 R-1320-DOT July 1973 162p.
N74-11435

A study was conducted to identify and quantify the major benefits to aircraft operators, passengers, and shippers arising from improvements to the air traffic control system. The study emphasized the following subjects: (1) increased terminal area capacity and (2) improved aviation safety. The types of aviation considered were general aviation, certified air carriers, and military operations. The basic measure of the safety improvements is the number of accidents that might be avoided or prevented through introduction of the improved air traffic control system.

405. Klass, Philip J.

Aircraft Conflict Alert Technique Tested.

Aviation Week & Space Technology vol. 99, no. 20, p. 59-60, November 12, 1973

New sub-routine for FAA computers (IBM-9020) that will enable them to alert enroute traffic controllers automatically to a potential conflict between aircraft operating in controlled airspace has been successfully demonstrated by Mitre Corp. scientists. This automatic "conflict-alert" capabilities requires no additional hardware beyond that already being installed for the NAS Stage-A enroute center automation program. Equally important, the new feature imposes no added workload for traffic controllers.

406. Klass, Philip J.

Anti-Collision Program Detailed.

Aviation Week & Space Technology vol. 105, no. 14, p. 27--29. October 4, 1976

Reviews discussions of the Consultative Planning Conference. FAA's 10-year effort to eliminate hazard will not involve regulatory action or new user hardware for first two years. During the next several years, principal gains will come from automatic conflict alert provisions recently introduced at the FAA's 20 enroute traffic control centers.

407. Klass, Philip J.

Anti-Collision Sytems Report Readied.

Aviation Week & Space Technology vol. 100, no. 6, p. 38 - 41, February 11, 1974

FAA is expected to recommend that Congress not take steps to make collision avoidance systems mandatory. Chart analyses midair collisions for eight-year period 1964 through 1971. It was made by the FAA to better evaluate the problem and the possible effect of recent and scheduled improvements in ground-based traffic control system as well as potential contribution of independent airborne collision avoidance systems.

408. Klass, Philip J.

Bendix Flight-Tests a 'Listen-In' PWI.

Aviation Week & Space Technology vol. 97, no. 13, p. 90, 91, 93, September 25, 1972

The improved PWI of the radar-transponder "listen-in type", which incorporates several new features intended to reduce unnecessary warnings and to facilitate threat evaluation, is being tested by Bendix Avionics. One new feature is a direction finding capability that automatically shows the approximate bearing of other aircraft whose transponder signals are being received. Another feature is a means of filtering out transponder replies from aircraft that are at a much higher or lower altitude and therefore pose no immediate threat.

409. Klass, Philip J.

Collision Avoidance System Demonstrated.

Aviation Week & Space Technology, vol. 107, no. 20, p. 43, 45, 48, 49, November 17, 1975

Describes the flight tests of the Intermittent Positive Control (IPC) system which were conducted by Lincoln Laboratory. The system provides aircraft equipped with a modest-cost discrete-address-beacon system (DABS) type transponder and simple 3-in. dia. cockpit display with an automatic warning of the proximity of other transponder equipped aircraft that could pose a midair collision threat.

410. Klass, Philip J.

Collision Avoidance System Evaluated.

Aviation Week & Space Technology 104, no. 9, p. 55-57, March 1, 1976

Compares the two B-CAS systems being flight tested: the active B-CAS developed by Mitre Corporation and the semi-active B-CAS developed by Litchford Electronics. Because both systems rely upon signals received from aircraft transponders they are not mutually incompatible; therefore, a combination of both techniques might emerge as the optimum design.

411. Klass, Philip J.

Collision Warning/Landing Aid Tested.

Aviation Week & Space Technology vol. 101, no. 20, p. 47, 48, 50, 53, November 18, 1974

Recent FAA-sponsored flight tests have demonstrated that the Synchro-DABS can provide a low-cost, air-derived collision avoidance or proximity warning system in addition to its original transponder and data link functions.

412. Klass, Philip J.

DABS in Flight Test Evaluation.

Aviation Week & Space Technology vol. 99, no. 4, p. 44-45, 48-49, 51, July 23, 1973

Experimental Discrete Address Beacon System is expected to be the cornerstone of FAA's future air traffic control system. In addition to providing an improved air-surveillance radar beacon system to cope with growing air traffic, DABS will provide a new function -- ground-to-aircraft data link communications of routine air traffic control information and advisories. This in turn will permit the introduction of a new class of service, called Intermittent Positive Control (IPC) that will enable general aviation aircraft to enjoy many of the advantages of positive control flight without many of the associated constraints and costs. The combination of DABS and IPC is

expected to greatly reduce the number of midair collisions, most of which involve at least one aircraft that is not operating under positive control.

413. Klass, Philip J.

Extension Sought on CAS Flight Testing.

Aviation Week & Space Technology vol. 100, no. 22, p. 53-55, June 3, 1974

Review of the progress report presented by FAA during the hearings held by the Senate Commerce aviation subcommittee. FAA requested it be given an additional 12-18 months to complete its flight test evaluation of several competing airborne collision avoidance systems.

414. Klass, Philip J.

FAA Cuts Collision Avoidance Options.

Aviation Week & Space Technology vol. 106, no. 19, p.57-59, May 9, 1977

Pros and cons of the current CAS systems are given. Multimode airborne collision avoidance system that can use existing airborne radar transponders and automatically adapt its operating mode to its environment is the leading contender for FAA selection as a national standard. This system uses many of the techniques pioneered by George B. Litchford for his simple, passive proximity warning indicator devised a decade ago. Air Transport Assn., does not endorse the selection.

415. Klass, Philip J.

FAA Refines Anti-Collision Plan Details.

Aviation Week & Space Technology vol. 104, no. 11, p. 172, 175, 177, 179, 181, March 15, 1976

The FAA has decided that the optimum airborne collision avoidance system technique is one that, initially, makes use of the ATCRBS airborne transponders now in service. At this writing the agency had not decided between an active type of B-CAS, using techniques developed jointly by FAA and Mitre Corp., and semiactive B-CAS, developed by Litchford Electronics, or some hybrid of the two. Discusses some of the difficult technical and political issues that the FAA had to resolve before making a final choice.

416. Klass, Philip J.

Further Time Required for CAS Choice.

Aviation Week & Space Technology vol. 104, no. 1, p. 27-28, January 5, 1976

Reviews the independent CAS systems of RCA and Honeywell and the two beacon CAS systems of Mitre and Litchford.

417. Klass, Philip J.

Other Uses for Beacon System Studied.

Aviation Week & Space Technology Vol. 97, no. 18, p. 44-47, October 30, 1972

Modification of discrete-address beacon system could give it airborne collision warning and distance measuring capability. Synchro-DABS as developed by Dr. Thomas Amlie of the FAA would enable each equipped aircraft to measure the distance and closing rate of other aircraft, using a one-way ranging technique similar to that employed in the airline-sponsored time-frequency CAS.

418. Koenke, E.J., Ebert, P.M., Harman, W.H., Spencer, N.A., and Weinberg, A.

A Preliminary Evaluation of the ATCRBS Signal Format for the BCAS Data Link.

Federal Aviation Administration, Office of Systems Engineering Management FAA Report EM 77-9 August 31, 1977 38p.

The evaluation of the integrety of the ATCRBS Signal format for the BCAS data link was based on measurements of the actual RF environment today, simulations of sophisticated signal processors, and basic calculations. The conclusions reached by the task force all relate to achieving a high integrity data link tailored to the BCAS application and were derived from tests run on the DABS ground-based reply processor. They are the following: (1) A data link with a high degree of error protection coding is essential; (2) Multiple transmissions -- itself a form of coding -- is essential; (3) A two-way data link is highly desirable from the point of view of the coordination logic.

419. Koenke, E.J. and Garot, J.M.

Surveillance and Data Link Enhancement Program.

Federal Aviation Administration, International Staff Report EM 77-7 January 1977 33p. AD-A041 299

On December 10, 1976, the Administrator, U.S., FAA and the Director General, French Civil Aviation, signed a Memorandum of Cooperation (MOC) to mutually establish a Surveillance and Data Link Enhancement Program. This document provides the background and rationale that prompted this program and describes the results of the plenary meeting held under the auspices of the MOC. The purpose is to jointly develop parameters for a common future (post-2000 A.D.) ATC system. This includes communications, surveillance, approach and guidance technology, and navigation. Fundamental to the success of the highly automated ATC system anticipated in the year 2000 and beyond is the ability of the system to perform automatic conflict detection and resolution.

420. Koenke, Edmund J. and Tymczyszyn, Joseph P.

Multi-Site Interrogation Scheduling for the Discrete Address Beacon System.

Federal Aviation Administration Report EM 74-14 September 1974 97p. AD-787 231 N75-12920

A theoretical analysis and computer simulation were undertaken to develop a DABS/ATCRBS scheduling algorithm which would be capable of servicing the projected Los Angeles Basin.

421. Kontos, Ted

When Two's a Crowd.

U.S. Army Aviation Digest vol. 19, no. 10, p. 30-34, October 1973

While warning devices hold the best promise for eliminating the threat of midair collisions, they can only assist the pilot. Final responsibility must still rest with the crew, especially the aviator in command, and his ability to spot potential targets in time to prevent midair collisions. Understanding how to visually sight other aircraft and knowing the correct procedures to follow will ensure that two aircraft in the air will always be company -- and never a crowd.

422. Kowalski, Stanley, Haspert, J.K. and Witt, James.

Cost Analysis of the Airborne Portion of Discrete Address Beacon System Intermittent Positive Control (DABS/IPC) Concept.

Arinc Research Corp. Contract DOT-FA74WA-3506 FAA Report EM 76-2
December 1975 249p. AD-A023 538 N76-26179

The results of the cost and reliability evaluations developed for discrete and LSI versions of the airborne portion of the DABS/IPC concept were presented. To provide a basis for assessing the economic impact of DABS on the various aviation communities, separate cost evaluations have been developed for general aviation, commercial aviation, and the military. The expected cost of ownership to the individual aircraft owner was presented as well as the cumulative life-cycle cost to the user communities, based on the developed data.

423. Kowalski, Stanley, Haspert J. Kent and Witt, James

Cost Analysis of Airborne Collision Avoidance Systems (CAS) Concepts.

Arinc Research Corp. Contract DOT-FA74WA-3506 FAA Report EM-76-1
December 1975 266p. AD-A023 080 N76-26170

The results of the cost and operational evaluations developed for three CAS concepts: the Honeywell AVOIDS, the McDonnell Douglas EROS and the RCA SECANT were presented. To provide a basis for assessing the economic impact of CAS on the various aviation communities, separate cost evaluations have also been developed for general aviation, commercial aviation, and the military. The expected cost of ownership to the individual aircraft owner was presented as well as the cumulative life-cycle costs to the user communities, based on the competing manufacturers' data and independently developed electronics and installation cost data.

424. Krinitz, Arthur.

A Review and Analysis of the McDonnell Douglas Collision Avoidance System, Phase II.

Institute for Defense Analyses Contract DOT-FA74WA-3498 Study S458
FAA Report RD75-143 October 1975 92p. AD-A021 679 N76-23247

The MDEC CAS is an air-derived synchronous system based on time/frequency multiplexing techniques -- synchronization timing is disseminated by ground stations and by air-to-air relay among appropriately equipped aircraft.

425. Krinitz, Arthur

A Review and Analysis of the Sierra DME Collision Avoidance System.

Institute for Defense Analyses Study S-456 FAA Report RD 75-141
October 1975 127p. AD-A021 634 N76-23237

The DME/CAS is an air-derived synchronous concept intended to exploit the proliferated network of DME ground facilities to obtain synchronization and to adapt airborne DME designs for time-sharing between the DME and CAS functions. DME ground facilities would be augmented to transmit a CAS time reference signal, in addition to normal DME replies; airborne clocks would be synchronized to the received reference, after correction for the propagation delay obtained by DME techniques. Synchronized CAS participants transmit and receive one-way range and encoded altitude signals for threat evaluation in accordance with the ANTC-117 threat logic.

426. Lack of Flightcrew Visual Scanning Probable Cause of Near Midair.

ATCA Bulletin No. 73-1 p. 4-5 January 1973

The NTSB report on a near midair collision of a Northwest Airlines Boeing 720B and a general aviation Convair 240 near Front Royal, Virginia, April 26, 1972 emphasized the need to use the 'see and avoid concept'.

427. LaFond, Charles D.

A New Collision Avoidance Contender Surfaces.

Government Executive vol. 4, no. 12, p. 42-43, December 1972

By modifying a previously successful military proximity warning indicator, Honeywell engineers have produced a family of units for civil application that vary in capability and price range for all aircraft categories, provide a high safety reliability and a low false alarm rate and will function properly in the expected air congestion of the 1980's. Developers claim the CAS concept meets the requirements of both FAA's Alexander Report and the Airline ATC Committee. The newly developed units are called AVOIDS, an acronym derived from: Avionic Observation of Intruder Danger Systems.

428. Langley, John V.

ADSEL In the United Kingdom -- Plans and Progress.

AEEC Letter N76-106/AXX-00 October 11, 1976 4p.

Paper presented at the AEEC Avionics Engineering Seminar on Beacon-Based Separation Assurance Systems, held at Munich, Germany, September 3, 1976. ADSEL stands for Address Selective SSR. There is no significant difference between ADSEL and the basic DABS.

429. Language Usage Studied in Midair Collision.

Aviation Week & Space Technology vol. 105, no. 12, p.32 September 20, 1976

Question of whether a language mixup may have contributed to a midair collision over Zagreb, Yugoslavia, killing 176 persons, dominated opening sessions of a judicial inquiry attended by technical teams from British and German accident investigation departments and British Airways. The aircraft, a British Airways Trident 3 and Inex-Adria McDonnell Douglas DC-9-32, collided in good weather at 11:34 A.M., Friday, September 10, 1976 at 33,000 feet on airways near Zagreb. Hearing initially will concentrate on whether the Yugoslav transport was being controlled in the Serbo-Croat language, instead of English the official international aviation language.

430. Lanham, J.C. and Dixon, R.

Qualification Tests for Aircraft Lighting Equipment (Symbolic Displays, Incorporated P/N 7146, Anticollision Strobe Lights).

Naval Air Test Center Report No. WST-19R-73 January 26, 1973 AD 907 207

Electromagnetic interference tests on two strobe lights. Both failed to meet the broad and narrowband conducted and broadband radiated interference requirements of MIL-STD-461.

431. Larger TCA's, Mode C Requirement in Offing.

AOPA Pilot vol. 15, no. 6, p. 81, 83, 84, June 1972

FAA's National Aviation System Plan (NASP) calls for larger airspace configurations, and a 4096 code transponder with Mode C automatic altitude reporting within the designated terminal radar service area for all aircraft.

432. Lauber, Frederick, J.

Preventing Collisions with the T/F CAS (Time/Frequency Collision Avoidance System.)

Interceptor vol. 14, p. 18-22, August 1972

433. Lavine, Arthur A.

Statement of the President, LEXco.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972, p. 261-264.

In answer to the obstacle collision threat for all material obstacles within the collision threat zone of an aircraft regardless of obstacle size, LEXco. proposes the use and adoption of its laser collision warning and avoidance system.

434. Lee, Lincoln

Separation Cut Means Lower Atlantic Costs.

Flight International vol. 112, no. 3586, p. 1747-1748, December 10, 1977

Beginning December 29, 1977 Minimum Navigation Performance Specification (MNPS) airspace will be in effect, thus reducing operating costs and resolve some oceanic airspace congestion problems. It is expected that by October 1978 there can be a reduction in lateral separation from the current 120 n.m. to 60 n.m.

435. Leeper, J.L. and Tvirbutas, A.A.

Empirical Characterization of IPC Tracker Performance Using DABS Data.

Massachusetts Institute of Technology, Lincoln Laboratory in cooperation with ARCON Corp. Contract DOT-FA72WAI-261 FAA Report RD 75-234 (ATC-61) June 1976 84p. AD-A027 778

The performance of a set of tracker algorithms proposed for use in the DABS-based Intermittent Positive Control (IPC) collision avoidance system is assessed. Effects of turn-rate, speed, wind and surveillance accuracy upon heading error, speed error and position error are presented.

436. Levy, Joseph and Ranger, Frederick

Test and Evaluation of a Conflict Alert Capability for the NAS Enroute System.

FAA, NAFEC Project no. 122-111-010 Report RD74-15 (NA73-80), February 1974 19p. AD 776 145 N74-33126

The purpose of this activity was to test and evaluate the operational suitability of conflict alert, a ground based collision prevention automation aid, developed for the Model 3d program of the National Airspace System. The Conflict Alert function, which provides radar controllers with a displayed alert for potential violation of radar separation standards among tracked aircraft was successfully integrated into the NAS Enroute Model 1 system.

437. Lewis, Mark F.

Frequency of Anti-Collision Observing Responses by Solo Pilots as a Function of Traffic Density, ATC Traffic Warnings, and Competing Behavior.

FAA, Civil Aeromedical Institute, Report AM 73-6 April 1973 6p.
AD 763 557 N73-27015

Aerospace Medicine vol. 44, p. 1048-1050, September 1973

Studies of human vigilance are numerous, but the techniques available have not yet been applied to collision avoidance. The current study applies the operant technique developed by J. G. Holland for the study of observing responses in attempt to isolate the relevant variables that affect pilot vigilance in collision avoidance.

438. Linnert, T. G.

Aircraft Collision Prevention -- A Worldwide Problem.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 83-98

In: IFALPA NEWNAV Symposium, Frankfurt am Main, West Germany, October 5-7, 1971, report. Volume 2. p. III-3-1 to III-3-16. Frankfurt am Main, Vereinigung Cockpit, 1972.

Discussion of the collision hazard situation in the vicinity of major airports, and review of the urgent need for expediting midair collision prevention. Considered collision prevention approaches include: (1) strobe anticollision lighting on aircraft as an aid for reducing the collision hazard; (2) expanded research and development of a collision avoidance system for all aircraft; and (3) expanded research and development for a proximity warning indicator.

439. Litchford, George B.

Avoiding Midair Collisions.

Air Line Pilot vol. 45, no. 2, p. 14-16, 43, February 1976

Summarizes the Litchford Beacon Collision-Avoidance System. It utilizes much of the existing and proposed ground based identification system to provide additional information to the pilot necessary for the avoidance of midairs. It operates passively for most of the operational cycle but can actively solicit responses from other aircraft.

440. Litchford, George B.

Avoiding Midair Collisions.

IEEE Spectrum vol. 12, no. 9, p. 41-48, September 1975

The author describes his system for an airborne collision avoidance which is being developed and exploits the existing ATCRBS network by utilizing the signals transmitted between ground stations and aircraft during the ordinary course of air traffic control. With these signals, a pilot in a suitably equipped aircraft can learn of impending danger from other planes in his vicinity. Called Semiactive BCAS, because, for the most part, it operates passively using receivers to intercept other aircraft transmissions but, in exceptional cases, can actively solicit responses directly from other aircraft, the system imposes minimum and inexpensive changes in the present ATCRBS network, and does not require additional transponders aboard aircraft.

441. Litchford, George B.

BCAS Puts the Pilot Back in Control.

Flight Operations vol. 66, no. 12, p. 21 -- 28, December 1977

The author describes his semiactive collision avoidance system. BCAS will allow the pilot to determine his separation assurance and collision avoidance data with air-derived measurements. The system utilizes equipment already aboard 130,000 or more aircraft.

442. Litchford, George B.

Broadcast Control of Air Traffic.

Litchford Systems Contract NASw-2247 NASA-CR-127 452 April 1972
162p. N72-28662

The development of a system of broadcast control for improved flight safety and air traffic control is discussed. The system provides a balance of equality between improved cockpit guidance and control capability and ground control in order to provide the pilot with a greater degree of participation. The manner in which the system is operated and the equipment required for safe operation are examined.

443. Litchford, George B.

Collision Avoidance.

Aviation Week & Space Technology, vol. 106, no. 22, p. 62, May 30, 1977

Letter in answer to Klass article (May 9, 1977, p. 57) and takes exception to some of the statements made.

444. Litchford, George B.

Collision Avoidance.

Aviation Week & Space Technology vol. 107, no. 4, p. 66, July 25, 1977

Letter in response to a McComas letter (AW&ST June 27, p. 94). Defends the FAA selection of his BCAS, claiming it protects in all airspace.

445. Litchford, George B.

Letter in answer to January 5, p. 27 article in Aviation Week.

Aviation Week & Space Technology vol. 104, no. 9, p. 70, March 1, 1976

Tells why his system is preferable BCAS to Mitre system, which would threaten dense air traffic environments, by operating only in the receiving mode.

446. Litchford, George B.

SSR-CAS: A Collision avoidance system employing ATC secondary surveillance radars.

ICAO Bulletin vol. 31, no. 3, p. 22-25, March 1976

This concept makes use of existing ground and airborne equipment to provide air-derived threat evaluation.

447. Litchford Electronics, Inc., Megadata Corporation and Hulland Engineering

Hardware and Software for Beacon Collision Avoidance System (BCAS)

Contract DOT-TSC-1103 March 1977 3 vols.

The objective of this contract called for advancing BCAS concept by means of new hardware and software to prove the feasibility of various aspects of the system in actual flight, aboard Government aircraft.

448. Litchford Electronics, Inc., Megadata Computer and Communications Corp., Hulland Engineering and Nachman Associates.

Final Report for Feasibility Testing of Secondary Surveillance Radar Collision Avoidance System (SSR-CAS).

Prepared for Electronic Systems Division, Air Force Systems Command Contract F19628-75-C-0193 June 1976 274p.

This report describes some of the precision measurements of passive range and bearing that were made with the Litchford SSR-CAS (or Litchford BCAS). Actual aircraft transponder signals were used that conveyed the altitude and identity messages of the target. Bore-sight measurements from atop a few tall buildings in New York confirmed that bearing and range accuracies were unexpectedly high even in cases of unfavorable geometrics and multipath.

449. Litchford Electronics, Inc., Megadata Computer and Communications Corp., Hulland Engineering and Nachman Associates

Study of Collision Avoidance and Proximity Warning Using the National Air Traffic Control Radar Beacon System.

Prepared for Electronic Systems Division, Air Force Systems Command, Final report as part of Phase III Contract F19628-72-C-0377 January 1974 3 vols.

In its simplest form, the SSR PWI-CAS makes use of an airborne receiver to intercept standardized, reply messages from the existing 100,000 transponder-equipped aircraft. Each aircraft replies to one or more of the nearly 700 ground stations of the national ATCRBS. This is a compilation of the 9 Progress Reports prepared under the contract, as well as the Final Report.

450. Lloyd, D.E.

Components of Height-Keeping Error.

International Civil Aviation Organization Review of the General Concept of Separation Panel (RGCSP) RGCSP-WP/46 Montreal August 1975

451. Lloyd, D. E.

The Specification of Navigational Capability in Relation to North Atlantic Separation Standards.

Royal Aircraft Establishment RAE TR-72175 October 1972 51p.

The paper investigates the relationship between the required lateral separation standard and a specification of navigation capability. Subsonic and supersonic aircraft are considered. Accuracy and reliability requirements for navigation equipment are derived. Collision risks are compared for two possible types of SST track structures.

452. Lloyd, D.E.

Studies of System Track-Keeping Accuracy and Spacing of Twin-Track Airways.

International Air Transport Association, 19th Technical Conference, Dublin, October 23-28, 1972 WP-45 12p.

This paper describes a preliminary study to compare two systems for providing safe lateral separation between opposite-direction tracks. In the first system, termed "procedural" there is no direct radar intervention to correct significant deviations from track when they arise. That is, the tracks are deemed to be procedurally separated from each other. It is envisaged that radar would be used in an "off-line" role to record any significant deviations. Then their causes could be investigated and as far as possible cured, so progressively improving the navigation system: also large amounts of data on track-keeping accuracy would be obtained, so that a safe lateral separation standard could be estimated. In the second system, termed "Radar Monitored" the traffic controller instructs an aircraft to regain track when it appears on his screen to be straying too far towards the other track.

453. Lloyd, D.E. and Scott, P.P.

Application of Monte Carlo Methods to Estimation of Collision Risks Associated with ATC Separation Standards.

Royal Aircraft Establishment Report No. RAE-TR-73104 June 1973 46p. AD 773 313 N74-19283

The risk of collision between two aircraft, which are nominally separated by standard air traffic control procedures, depends on several quantities which cannot be determined exactly. This risk can, however, be estimated in several ways, one of which is to assign each indeterminate quantity a probability distribution and use of Monte Carlo methods to combine these, giving a distribution of risk. It is this approach which is described in this report. Also presented is an example of the application of these methods, to the safety assessment of a proposed 90 mile lateral separation standard for North Atlantic jet aircraft.

454. Lotze, H.E., Jr.

Strobe Light SitRep

Approach vol. 19, no. 7, p. 6-9, January 1974

Recently, a great deal of interest has been shown concerning the use of strobe lights for collision avoidance. This article attempts to answer some of the questions regarding their use and FAA requirements.

455. Lucarelli, G.

Use of Doppler Measurements from Artificial Satellites for Collision Avoidance.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany, October 2-5, 1973. Sponsored by the European and American Institutes of Navigation. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 1 14p.

It is shown that two successive measurements involving a single satellite provide sufficient data for the determination of the position coordinates of a ground vehicle. The precision of the determination depends on the errors in the estimation of the motion of the vehicle and the satellite and on inaccuracies in the parameter values of the equation used in the calculation. The effects of the errors on the positional accuracy are investigated along with the accuracy obtainable in a determination of the differences between the positions of two vehicles which are close to each other.

456. Luciani, Vincent J.

Test and Evaluation of a System for Precise Time Dissemination Using DME(VORTAC) Synchronization.

FAA, NAFEC Report RD 73-104 (NA73-23) August 1973 58p. N73-30652

The test and evaluation of an experimental system designed to provide precise time to aircraft via a DME(VORTAC) ground station modified to utilize a cesium-beam atomic clock for a time base are discussed. Data acquired from a flight test demonstrated the feasibility of this time-dissemination concept for application in time/frequency collision avoidance systems. The standard deviation of time-dissemination error was found to be 0.47 microseconds. DME one-way ranging capability was also demonstrated, wherein ranging accuracy of a modified airborne DME operated one-way averaged 0.1-nautical mile difference over that of an unmodified airborne DME in conventional two-way operation.

457. Lundquist, G.E.

Developments in the Management and Utilization of Airspace.

In: Anglo-American Aeronautical Conference, 13th, London, England, June 4-8, 1973, Proceedings. London, Royal Aeronautical Society, 1973. 12p.

The upgraded third-generation ATC system is described which is intended to enhance the capabilities of the present ARTS III and NAS Stage A systems and includes such features as a discrete address beacon system, an electronic voice switching system, a microwave landing system, and aeronautical satellites. The possibility of incorporating intermittent positive control in the upgraded third-generation ATC system, once the discrete address beacon system is complete, is considered.

458. Lundquist, Gustav E.

A New Generation ATC. Concept includes DABS, EVS, IPC, MLS, RNAV and Central Control.

Flight vol. 62, no. 10, p. 48-49, 52, September 1973

Review of an address to the Royal Aeronautical Society in London recently. A basic premise of the upgraded third generation system is that the current ground-based system will be the primary means of airborne collision avoidance. That is, with all aircraft "locked up" and being tracked by ground, the intermittent positive control is providing a form of ground-based collision avoidance system.

459. Lundquist, Gustav E.

Report of the Chairman of the Delegation of the United States of America to the ICAO Seventh Air Navigation Conference, Montreal, Canada, 5-29 April 1972.

FAA, Interagency Group on International Aviation IGIA 72/1.138 May 8, 1972 80p.

Agenda Item 7: Systems for Collision Avoidance. Two descriptive terms were adopted, the first being that for an Airborne Collision Avoidance System (ACAS) and the second being that for Airborne Proximity Warning Indicator (APWI).

460. Lyons, J.

Summary of Visual Detection Data.

In: Control Data Corp. Air-to-air Visual Detection Data. Part 2 Report FAA-RD-73-40 April 1973 19p. N73-21145

Flights were conducted in which two aircraft set out on collision or near-miss courses in order to provide photographic data for use in a simulator. Data on the time and range of first visual detection of each aircraft by the crew of the other aircraft were recorded.

461. Lyons, J.F.

Preliminary PWI Specifications.

Control Data Corporation Contract DOT-FA70WA-2263 Report No. CDC-JL-1 December 1971 34p.

Presents specifications for seven hypothetical PWI systems.

462. Lyons, J.F., Mangulis, V., and Graham, W.

Preliminary PWI Specifications and Threat Logic.

Control Data Corporation, Washington Systems Division Interim Report. Contract DOT-FA70WA-2263, FAA Report RD 71-116 December 1971 116p. AD741 151

Report contains a two part report by V. Mangulis and W. Graham, "Threat Logic and Alarm Rates in PWI and CAS Equipment." This contract has as its primary objective the estimation of the potential benefit to be derived by the various users of the air-space through the implementation of PWI systems of various degrees of sophistication. It is proposed to measure the potential effectiveness of various systems by exercising them through simulation with pilots who are busy with workloads appropriate to their mission.

463. McAulay, R.J. and Vitto, V.

A Simulation of the DABS Sensor for Evaluating Reply Processor Performance.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72WAI-261 Report RD 74-123 (ATC-28) September 1974 49p. AD-787 633 N75-12919

In order to evaluate the effects of Air Traffic Control Radar Beacon System interference on the design of DABS sensor, a simulation program was developed. A detailed model of the sensor is presented that takes into account many of the antenna pattern and signal processing design parameters. A model for the fruit generator was developed so that reply processor performance in typical 1980 high density fruit environments can be evaluated.

464. McCaddon, Joseph F.

Statement of Division Vice President, Aviation Equipment Department, RCA; accompanied by Larry Parsons, SECANT Program Manager; and Jack Breckman, inventor of SECANT and Technical Director for Collision Avoidance Studies.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 120-126

Discusses the value of SECANT over the other systems.

465. McComas, A.D.

Collision Avoidance.

Aviation Week & Space Technology vol. 106, no. 26, p. 94, June 27, 1977

Answer to George Litchford's letter of May 30, 1977, p. 62, regarding single versus multiple station capability of various BCAS concepts currently under consideration. The author maintains that neither the Litchford nor the Koenke system obtain bearing information in their active modes and thereby fail in his judgment to provide the uniform collision threat measurement performance which is required to present consistent alarm characteristics, quality of warning, types of maneuver commands, and acceptable false alarm rates to the pilot.

466. McComas, A.D.

Collision Avoidance.

Aviation Week & Space Technology vol. 107, no. 7, p. 68, August 15, 1977

Lists five points in rebuttal with George Litchford's letter of July 25, 1977, p. 66. Emphasizes the fact that no air derived CAS system will operate in dense terminal airspace. DABS/IPC is a necessary part of a comprehensive separation assurance program. The known incompatibility of the Litchford BCAS concept with DABS (as well as with the upgraded ATCRBS) thus represents an extremely important issue, because if implemented in that form BCAS would have the effect of "freezing" the ATC system as it exists today.

467. McComas, A.D. et al

Synchronized Discrete Address Beacon System (Synchro-DABS) Study.

Bendix Corporation Contract DOT-FA72WA-2888 FAA Report EM-73-1
January 8, 1973 388p. AD 758 271 N73-20189

The report describes the results of a study to determine the problems, benefits, and costs of synchronizing the DABS system such as to provide each airborne participant with certain optional aeronautical services. A system concept is developed and documented to the extent necessary to establish a basis for estimating the costs of representative avionics options. The costs and technical descriptions of 12 configurations are developed to various degrees, beginning with a basic DABS transponder with IPC and progressing through ATC Data Link, PWI, CAS, DME and cockpit PPI displays.

468. McCusker, J.H., Perlman, S.S. and Veloric, H.S.

Microsonic Pulse Filters -- Replacements for Traditional Butterworth Designs.

RCA Review vol. 37, p. 389 - 403 September 1976

Microsonic filter response characteristics are analyzed under CW, pulsed, and transient input conditions. Previous CW formulations had to be extended for pulsed and transient response calculations because the acoustic waves generated are not, in general, spatially long enough to encompass the entire transducer pattern. A synthesis procedure is also developed and used for the successful design of six pulse filters employed in a practical airborne collision-avoidance system, SECANT VECAS GM/A.

469. McDonald, Keith D.

The Satellite As an Aid To Air Traffic Control.

In: AGARD A Survey of Modern Air Traffic Control. AGARD-AG-209
Vol. 2, p. 661-697 (1975) N75-32066

The capabilities and potential are discussed of satellite based systems for navigation and air traffic control. The utility of satellite systems was extended from communications, surface navigation, and geodetic applications into air and space, and to other functional areas such as position surveillance for air traffic control, precise time and time transfer, international maritime and aeronautical position location and reporting services and collision avoidance.

470. McDonald, Keith D.

A Survey of Satellite-Based Systems for Navigation, Position Surveillance, Traffic Control, and Collision Avoidance.

Navigation vol. 20, no. 4, p. 301--320, Winter 1973-1974

In: National Aerospace Meeting, Washington, D.C., March 13, 14, 1973, Proceedings. Addendum. Washington, D.C., Institute of Navigation, 1973. 16p.

Summary of the satellite concepts, orbital deployments, and measurement techniques on which the accomplishment of various recent applications is based. The systems and system concepts discussed include: Transit (Navy); Expanded Transit and Transit improvement program; the Two-in-View configuration; the Defense Navigation Satellite System, including the System 621B and the Timation system concepts; the NASA Position Location and Communication Equipment (PLACE) experiment; the Maritime Satellite program of Department of Commerce's Maritime Administration; the DOT/FAA Aeronautical Satellite Program; the Location, Identification by Transmission (LIT) and Satellite ATC and Navigation (SATAN) systems; the DOT's Advanced Air Traffic Management System concepts; and the FAA's recently developed ASTRO-DABS concept.

471. McDonnell Douglas Electronics Company

Analysis of the Traffic Handling Capability of the SECANT System.

Report MDC-M0008 February 7, 1972 93p.

Results of an extensive evaluation of the RCA technique. "It reveals that the SECANT concept not only saturates in 1971 traffic conditions, but also is highly sensitive to parameters with which other collision avoidance concepts have no difficulty." Anatole Browde

472. McDonnell Douglas Electronics Company

United Air Lines Evaluation Program McDonnell Douglas EROS II Collision Avoidance System.

Prepared in Cooperation with United Air Lines. Report MDC-M0013 June 1972 125p.

Evaluation of the MDEC EROS II Model 2000 Collision Avoidance System by flight tests for three months in an United Airlines Boeing 727-222 aircraft. The EROS II Model 2000 is an ATA Time/Frequency system conforming to the requirements of ARINC Characteristic 587. It performed to complete satisfaction during the testing. Two demonstrations of the ATA CAS/Micro CAS (general aviation) took place in February 1972 installed in FAA approved Cessna Model 172 aircraft. These demonstrations included encounters overtaking, crossing, and head-on. The systems performed as advertised.

473. McEvoy, H. and Rawicz, H.C.

Advanced Concepts in Terminal Area Control Systems -- Aircraft Tracking and Collision Alert.

American Institute of Aeronautics and Astronautics and Gosudarstvennyi Komitet po Nauke i Tekhnike, USSR/US Aeronautical Technology Symposium, Moscow, USSR, July 23-27, 1973. Paper. 15p.

In connection with the expected increase in air traffic, approaches are being developed which will reduce the time the controller has to spend on functions which can be handled by a computer. The track-while-scan algorithm is considered, giving attention to Kalman filter development, aspects of Kalman filter simplification, measurement quantization, and filter models. A collision alert algorithm is also discussed together with aircraft parameter accuracy, filtering time, collision alert prediction time, and questions of computation time and storage.

474. McFarland, A. and Telsch, R.

Intermittent Positive Control Computer Algorithms for Test Bed Experiments.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM 74-2 (MTR-6528) October 1973 97p. AD-773 409

The report is intended to be used with the OSEM approved Intermittent Positive Control system description to initiate the programming of the IPC test bed systems. It applies to both the Discrete Address Beacon System Experimental Facility at MIT Lincoln Laboratories and the IPC Phase I experiments at NAFEC. Detailed flowcharts are provided and logical system interfaces discussed.

475. McFarland, A.L.

Description of a Data Tape to be Used for Benchmarking the Coding of the IPC Algorithms.

Mitre Corp. Contract DOT-FA70WA-2448 Report MTR-6626 March 13, 1974 21p.

The data tape contains a series of simulated ATCRBS or DABS position reports which simulate the output of a single DABS sensor. The aircraft tracks presented on the tape are involved in conflicts which exercise all significant portions of the IPC algorithms.

476. McFarland, A.L.

Multi-Site Intermittent Positive Control Algorithms for the Discrete Address Beacon System.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM 74-4 (MTR-6742) September 30, 1974 272p. AD-A001 112 N75-19214

This document presents complete detailed computer algorithms for implementing Intermittent Positive Control within a multi-site Discrete Address Beacon System network.

477. McFarland, A.L.

A Two Aircraft Monte-Carlo Simulation of an Intermittent Positive Control Resolution Algorithm.

Mitre Corp. Contract DOT-FA70WA-2448 Mitre Report MTR-6471 August 6, 1973 116p.

This report describes a conflict resolution algorithm, using both horizontal and vertical maneuvers and designed for use in an IPC system, and presents results of a two-aircraft Monte-Carlo test of this algorithm in which surveillance errors and pilot responses were simulated. The algorithm was designed to provide maximum separation even if one aircraft were not to respond to commands. 7000 different conflicts were simulated and resolved.

478. McFarland, A.L. et al

Multi-Site Intermittent Positive Control Algorithms for the Discrete Address Beacon System.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM74-4 Revision 2 (MTR-6742, Ch 2) May 1976 241p. AD-A026 515 N76-32147

This document presents complete detailed computer algorithms for implementing Intermitent Positive Control (IPC) within a multi-site Discrete Address Beacon System (DABS) network. It is to be used by the FAA to specify the IPC system which is to be provided as an integral part of the DABS Phase 2 system by the DABS System Development Contractor.

479. McFarland, A.L. and Golden, J.F.

Intermittent Positive Control Computer Algorithms for Test Bed Experiments.

Mitre Corp. Contract DOT-FA70WA-2448 FAA Report EM 74-2. Rev. 1 (MTR 6528 Rev. 1) April 1975 127p. AD AQ09 215 N75-29068

The report applies to both the DABS Experimental Facility at MIT Lincoln Laboratories and the IPC Phase I experiments at NAFEC. Detailed flow charts are provided and logical system interfaces discussed.

480. McFarland, A.L. and Horowitz, B.M.

A Description of the Intermittent Positive Control Concept.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM-74-1 (MTR-6587) February 11, 1974 73p. AD 776 111 N74-34149

Intermittent Positive Control is a totally automatic ground-based collision avoidance capability which, by issuing collision avoidance commands to aircraft on an "as needed" basis and by continuously providing pilots with information on the location of nearby aircraft, provides increased safety in mixed and uncontrolled airspace for both IFR and VFR aircraft, while maintaining the freedom of action associated with VFR flight. This documnet describes IPC and explains how it works.

481. McFarland, A.L. and Horowitz, B.M.

A Description of the Intermittent Positive Control Concept.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM-74-1, Revision 1 (MTR-6587, Rev. 1) July 1975 91p. AD-A013589 N75-32085

Intermittent Positive Control is a collision avoidance service provided to pilots by a totally automatic ground-based system. Collision avoidance is achieved by continuously providing pilots with advisory information on the location of nearby aircraft and by issuing avoidance commands on an "as needed" basis. IPC provides protection both for pilots who are and for pilots who are not operating under the control of the Air Traffic Control System, while maintaining the freedom of action associated with uncontrolled flight. This document discusses the equipment necessary to provide IPC, describes the various services that are performed by the IPC system, and explains the processes by which the system determines its actions.

482. McFarland, Alvin L. and Senne, Kenneth D.

U.S. Developing Two Concepts for Improved ATC Surveillance, Air/Ground Communications and Collision Avoidance. Part 2: IPC: Intermittent Positive Control.

ICAO Bulletin vol. 31, no. 3, p. 18-21, March 1976.

AEEC Letter N76-106/AXX-00 October 11, 1976

IPC is a DABS-based collision avoidance system. Its performance to date has demonstrated positive response by pilots in over 20 test flights.

483. McFarland, Alvin Leroy

Intermittent Positive Control of Air Traffic in a Horizontal Plane.

Purdue University Ph.D. Thesis 1972 280p. Univ. Microfilms Order No. 73-15835

The task of selecting a horizontal resolution maneuver is approached from the point of view of optimal control theory, choosing as a performance index to be minimized, the maneuver duration. One aircraft in the conflict maintains a constant velocity path. The problem reduces to that of selecting for the other aircraft the optimum flight path consisting of three circular arcs and two straight legs, which allows the two aircraft to pass with a separation no less than a specific value. The complete theoretical solution to the optimal control problem is stated. Because this exact solution is much too complex for use in practice, a suboptimal solution is proposed, and a means for evaluating the loss of optimality devised. The conflict resolution model and solution could also find appreciation in an automated positive control environment, in a nationwide flow control system, and with some adaptation, in terminal area metering and spacing schemes. Dissert. Abstr.

484. McGee, Leonard A, and Christensen, Jay V.

En Route Position and Time Control of Aircraft Using Kalman Filtering of Radio Aid Data.

National Aeronautics and Space Administration, Ames Research Center NASA-TN-D-7509 December 1973 103p. N74-12360

Fixed-time-of-arrival (FTA) guidance and navigation is investigated as a possible technique capable of operation within much more stringent en route separation standards and offering significant advantages in safety, higher traffic densities, and improved schedulting reliability, both en route and in the terminal areas. The guidance and navigation system was evaluated using a digital simulation of the cruise phase of supersonic and subsonic flights between San Francisco and New York City, and between New York City and London.

485. McIvor, D.E. and Matney, J.S.

Analysis of Intermittent Positive Control Conflict Rates and Computer Processing.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6175 April 7, 1972 102p.

Only a control procedure for handling VFR-VFR conflicts is considered. This control procedure is to allow aircraft freedom to maneuver at limited rates and issue conflict avoidance commands on an as needed basis. Computer algorithms have been developed for carrying out this procedure.

486. McLucas Says FAA Will Take Corrective Action On Near Collisions.

Aviation Daily vol. 222, no. 32, p. 251, December 17, 1975

Told House subcommittee the "every reported near midair incident is carefully investigated and when corrective action is warranted FAA will take it immediately." There were 207 reported near miss-air collisions through October 1975. He said 61 of those involved air carrier aircraft, but "in only four cases were both aircraft involved air carrier aircraft."

487. Machol, Robert E.

An Aircraft Collision Model.

Management Science vol. 21, no. 10, p. 1089--1101, June 1975

In the 1960's a controversy arose regarding the safety of navigation standards of jet aircraft over the North Atlantic Ocean, which led to a confrontation between airline owners and pilots. A system analysis led to a redesigned and improved system which resolved the controversy by giving each side at least as much as it originally requested, in terms of minimizing cost on the one hand and maximizing safety on the other. This paper describes the problem, the controversy, the model, the data collection and reduction, the solution, and the implementation.

488. Manders, Arnfinn M.

Interference by Unsynchronized ATCRBS in the CAS Mode of Synchro-DABS.

Mitre Corp. Contract DOT-FA70WA-2448 Report MTR-6632 March 19, 1974 30p.

A potential source of interference to the Synchro-DABS CAS system is ATCRBS transponders replying to unsynchronized ATCRBS interrogators. This analysis indicates that, while the problem is significant, Synchro-DABS CAS can be expected to perform well even in an environment where there are a limited number of unsynchronized interrogators present.

489. Mangulis, V. and Graham, W.

Threat Logic and Alarm Rates in PWI and CAS Equipment. 2 parts.

Control Data Corporation, Washington Systems Division Contract FA70WA-2263 Part 1. Report No. CDC-VM-2, December 1, 1970; Part 2, Report No. CDC-VM-3, May 17, 1971 Appendices to: Control Data Corporation Washington Systems Division Interim Report. Preliminary PWI Specifications and Threat Logic, by J.F. Lyons, V. Mangulis and W. Graham. FAA Report RD 71-116 December 1971. 74p. for the 2 parts.

Alarm and maneuver rates in a model terminal area and the average time in an alarm condition are calculated for an arriving air carrier flight which is protected by CAS or various PWI equipments. In Part 2 alarm rates are calculated for certain cooperative PWI systems of the type in which range is inferred from received signal strength.

490. Manuali, B.

Project Dioscures.

Ingegneria January 1972, p. 29-32 (In Italian)

Description of Project Dioscures designed to ensure air (and ship) traffic safety over the Atlantic and Pacific Oceans with the aid of a network of geostationary satellites. The proposed system is based on the simultaneous use of two geostationary satellites for radar tracking of aircraft. The project is characterized by the use of UHF L-band frequencies for the satellite-aircraft links, the use of multiplex transmission of numerical data to the aircraft, and the use of a multiple access system for data transmission from the aircraft to the ground station.

491. Marine Corps F-4B/Airwest DC-9 Midair Report.

ATCA Bulletin no. 73-1, p. 4, January 1973

The NTSB, reporting on the 50-fatality collision of a military fighter and an airliner climbing out from Los Angeles International Airport, recommended that climb and descent corridors be established above the new Terminal Control Areas at the nation's largest airports.

492. Martin, R.H.G. and Benoit, A.

Accurate Aircraft Trajectory Predictions Applied to Future En-Route Air Traffic Control

In: Handling the Air Traffic of the Long-Term Future: 19th Technical Conference, International Air Transport Association, Dublin, October 23-28, 1972. Montreal, Canada, IATA, 1973 WP-37 32p.

The paper describes recent studies being undertaken in the Eurocontrol Agency relating to three elements considered as forming a suitable basis for future en-route air traffic control systems in the more congested continental airspace. The three elements comprise improved traffic planning capability, automatic flight monitoring and an air/ground digital data link. Automatic conflict detection and resolution are covered.

493. Martin, Richard P.

Heads Up.

Aerospace Safety vol. 33, no. 5, p. 7-9, May 1977

Midair collision prevention, of major concern to all in the aviation community, is creating a large sophisticated effort. This article deals with an effective but simpler method for use in VMC -- heads up and eyes outside the cockpit, scanning the surroundings, the nearby air.

494. Martinez, Marty

Rx for Midairs

Air Line Pilot vol. 41, no. 11, p. 11, November 1972

NTSB directs prevention recommendations to FAA, pilots, carriers, airports and manufacturers of aircraft.

495. Marty, Morris L. and Spivey, Leroy B.

Army Midair Collisions.

U.S., Army Board for Aviation Accident Research Report no. 71-1 (date?) 15p.

In: U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO 1972. p. 246-260

This report contains analyses of 56 Army midair collisions which occurred during the period January 1963 to November 1969 and conclusions and recommendations based on the analyses.

496. Mason, Sammy

It Takes Two To Tangle.

Flight Operations vol. 65, no. 5, p. 10--13, 45, May 1976

The author quotes this statistic -- five percent of flying fatalities result from midair collisions. He gives some useful pointers to help the pilot overcome the handicaps of cockpit complexities, traffic traps around terminal areas, shortcomings in visibility and your eyes' own limitations. Emphasizes the need to be on the lookout for other aircraft.

497. Massachusetts Institute of Technology (MIT) Lincoln Laboratory

Quarterly Technical Summaries

Development of Discrete Address Beacon Systems

FAA-RD-72-44	QTS 1	1 April 1972	28 pages	AD743264
FAA-RD-72-76	QTS 2	1 July 1972	72 pages	AD747789
FAA-RD-72-117	QTS 3	1 October 1972	108 pages	AD752614
FAA-RD-73-12	QTS 4	1 January 1973	110 pages	AD758392
FAA-RD-73-48	QTS 5	1 April 1973	115 pages	AD762071
FAA-RD-73-101	QTS 6	1 July 1973	102 pages (See Ref. 500)	AD766601
FAA-RD-73-165	QTS 7	1 October 1973	64 pages	AD771207
FAA-RD-74-8	QTS 8	1 January 1974	81 pages	AD776118
FAA-RD-74-85	QTS 9	1 April 1974	88 pages	AD781326
FAA-RD-74-136	QTS 10	1 July 1974	78 pages	AD786272
FAA-RD-74-167	QTS 11	1 October 1974	74 pages	AD-A002399
FAA-RD-75-4	QTS 12	1 January 1975	72 pages	AD-A007060
FAA-RD-75-67	QTS 13	1 April 1975	80 pages (See Ref. 501)	AD-A010441
FAA-RD-75-114	QTS 14	1 July 1975	51 pages	AD-A014090
FAA-RD-75-166	QTS 15	1 October 1975	57 pages	AD-A019246
FAA-RD-76-10	QTS 16	1 January 1976	55 pages	AD-A023065
FAA-RD-76-82	QTS 17	1 April 1976	72 pages	AD-A027265
FAA-RD-76-126	QTS 18	1 July 1976	40 pages (See Ref. 502)	AD-A030368
FAA-RD-76-174	QTS 19	1 October 1976	68 pages (See Ref. 503)	AD-A035104
FAA-RD-77-7	QTS 20	1 January 1977	50 pages	AD-A037130
FAA-RD-77-64	QTS 21	1 April 1977	31 pages	AD-A041089
FAA-RD-77-107	QTS 22	1 July 1977	16 pages	
FAA-RD-77-159	QTS 23	1 October 1977	26 pages	

498. Massachusetts Institute of Technology (MIT) Lincoln Laboratory

Project Reports

Discrete Address Beacon System (DABS) Documents

FAA-RD-72-7	ATC-8	24 January 1972 59 pages Interrogation Scheduling for the Discrete Address Beacon System	E. J. Kelly AD737294
FAA-RD-72-30	ATC-9	12 April 1972 71 pages Final Report, Transponder Test Program	G. V. Colby E. A. Crocker AD740786
FAA-RD-72-84	ATC-12	14 August 1972 38 pages A Comparison of Immunity to Garbling for Three Candidate Modulation Schemes for DABS	D. A. Shnidman AD747566
FAA-RD-72-77	ATC-13	14 August 1972 57 pages Parallel Approach Survellance	J. B. Allen E. J. Denlinger AD747744
FAA-RD-72-100	ATC-15	29 November 1972 57 pages The Influence of Surveillance System Parameters on Automated Conflict Detection and Resolution	J. W. Andrews G. Prado (See Ref. 34) AD753407
FAA-RD-73-126	ATC-19	17 October 1973 106 pages Interrogation Scheduling Algorithms for a Discrete Address Beacon System	A. Spiridon A. D. Kaminsky AD770148
FAA-RD-74-4	ATC-20	28 January 1974 66 pages The Effects of ATCRBS P_2 Pulses on DABS Reliability	W. H. Harman D. A. Shnidman AD776141
FAA-RD-74-20	ATC-22	19 February 1974 82 pages Summary of Results of Antenna Design Cost Studies	J-C. Sureau AD776914
FAA-RD-73-160	ATC-25	28 November 1973 104 pages DABS/ATCRBS Transponder Bench Testing Program	J. R. Samson et al AD773768
FAA-RD-74-17	ATC-27	1 March 1974 46 pages A Summary of the DABS Transponder Design/Cost Studies	T. J. Goblick P. H. Robeck AD776140
FAA-RD-74-142	ATC-29	13 December 1974 16 pages DABS Timing: Clocks, Synchronization and Restart	E. J. Kelly AD-A002394

FAA-RD-73-175	ATC-30	9 November 1973 68 pages Provisional Signal Formats for the Discrete Address Beacon System	P. R. Drouilhet Editor AD77052
FAA-RD-74-62	ATC-30 Rev.1	25 April 1974 58 pages Provisional Signal Formats for the Discrete Address Beacon System (Revision 1)	P. R. Drouilhet Editor AD778387
FAA-RD-74-5	ATC-31	13 February 1974 56 pages Report on DABS/ATCRBS Field Testing Program	J. R. Samson,Jr. E. A. Crocker AD775290
FAA-RD-74-21	ATC-32	4 February 1974 26 pages The Effect of Phase Error on the DPSK Receiver Performance	D. A. Shnidman AD774675
FAA-RD-74-63	ATC-33	25 April 1974 41 pages Provisional Message Formats for the DABS/NAS interface	D. Reiner H. F. Vandevenne AD778450
FAA-RD-74-63A	ATC-33 Rev.1	10 October 1974 43 pages Provisional Message Formats for the DABS/NAS Interface (Revision 1)	D. Reiner H. F. Vandevenne AD-A000257
FAA-RD-74-64	ATC-34	25 April 1974 23 pages Provisional Data Link Interface Standard for the DABS Transponder	G. V. Colby et al AD778144
FAA-RD-74-83	ATC-35	24 May 1974 26 pages Provisional Message Formats and Protocols for the DABS IPC/PWI Display	P. H. Robeck J. D. Welch (See Ref. 697) AD780381
FAA-RD-74-84	ATC-36	20 May 1974 16 pages Provisional Message Formats and Protocols for the DABS 32-Character Alphanumeric Display	J. D. Welch G. V. Colby AD780159
FAA-RD-74-144	ATC-37	15 January 1975 115 pages An Analysis of Aircraft L-Band Beacon Antenna Patterns	G. J. Schlieckert AD-A005569
FAA-RD-74-145	ATC-38	13 December 1974 148 pages Further Studies of ATCRBS Based on ARTS-III Derived Data	A. G. Cameron AD-A005568

FAA-RD-74-162	ATC-40	4 March 1975 DABS Uplink Encoder	46 pages	J. R. Samson AD-A007621
FAA-RD-74-186	ATC-41	28 April 1975 DABS Link Performance Considerations	59 pages	G. J. Schlieckert AD-A009429
FAA-RD-74-189	ATC-42	18 November 1974 DABS: A System Description	96 pages	P. R. Drouilhet (See Ref. 186) AD-A005056
FAA-RD-74-197	ATC-43	8 January 1975 DABS Channel Management	246 pages	E. J. Kelly AD-A006759
FAA-RD-75-75	ATC-44	16 May 1975 Model Aircraft L-Band Beacon Anenna Pattern Gain Maps	153 pages	D. W. Mayweather AD-A013184
FAA-RD-75-8	ATC-45	16 May 1975 Network Management	102 pages	H. F. Vandevenne AD-A012398
FAA-RD-75-210	ATC-46	June 1975 Plan for Flight Testing Intermittent Positive Control	109 pages	J. W. Andrews et al (See Ref. 32) AD-A014040
FAA-RD-75-23	ATC-47	4 April 1975 Scale Model Pattern Measurements of Aircraft L-Band Antennas	147 pages	K. J. Keeping J-C. Sureau AD-A010479
FAA-RD-75-61	ATC-48	12 September 1975 DABS Downlink Coding	36 pages	J. T. Barrows AD-A016356
FAA-RD-75-62	ATC-49	25 July 1975 DABS Uplink Coding	42 pages	J. T. Barrows AD-A014915
FAA-RD-75-91	ATC-50	17 July 1975 Impact of Obstacle Shadows on Monopulse Azimuth Estimate	60 pages	A. Spiridon AD-A015139
FAA-RD-75-92	ATC-51	20 February 1976 DABS Sensor Interactions with ATC Facilities	53 pages	D. Reiner H. F. Vandevenne AD-A025427
FAA-RD-75-93	ATC-52	12 March 1976 DABS Modulation and Coding Design--A Summary	106 pages	T. J. Goblick AD-A024471

FAA-RD-75-112	ATC-53	3 February 1976 50 pages Summary of DABS Antenna Studies		J-C. Sureau AD-A021321
FAA-RD-75-113	ATC-54	2 February 1976 54 pages Design Validation of the Network Management Function		P. Mann H. F. Vandevenne AD-A021722
FAA-RD-75-145	ATC-56	14 November 1975 37 pages Discrete Address Beacon System (DABS) Test Plan for FY 1976		W. H. Harman AD-A018011
FAA-RD-76-22	ATC-57	16 March 1976 108 pages IPC Design Validation and Flight Testing - Interim Results		J. W. Andrews J. C. Koegler (See Ref. 33) AD-A024935
FAA-RD-75-233	ATC-60	25 March 1976 62 pages The Airborne Measurement Facility (AMF) System Description		G. V. Colby AD-A023868
FAA-RD-75-234	ATC-61	9 June 1976 84 pages Empirical Characterization of IPC Tracker Performance Using DABS Data		J. Leeper A. Tvirbutas (See Ref. 435) AD-A027778
FAA-RD-76-2	ATC-62	23 March 1976 22 pages Beacon CAS (BCAS) - An integrated Air/Ground Collision Avoidance System		V. A. Orlando J. D. Welch (See Ref. 643) AD-A023035
FAA-RD-76-39	ATC-65	31 January 1977 239 pages The ATCRBS Mode of DABS		J. L. Gertz AD-A038543
FAA-RD-77-143	ATC-71	30 September 1977 64 pages Proposed Technical Characteristics for the Discrete Address Beacon System (DABS)		J. D. Welch P. H. Robeck
FAA-RD-76-219	ATC-72	4 February 1977 96 pages DABS Monopulse Summary		D. Karp M. L. Wood AD-A038157
FAA-RD-77-30	ATC-73	25 April 1977 65 pages Air-to-Air Visual Acquisition Performance with Pilot Warning Instruments (PWI)		J. W. Andrews (See Ref. 31) AD-A039714
FAA-RD-77-77	ATC-75	16 August 1977 90 pages DABS Coverage		S. I. Krich

FAA-RD-77-78	ATC-76	7 June 1977 34 pages Effects of RF Power Deviations on BCAS Link Reliability	W. Harman AD-A044312
FAA-RD-77-87	ATC-77	6 September 1977 100 pages L-Band Air-to-Air Multipath Measurements	A. R. Paradis
FAA-RD-77-92	ATC-78	19 September 1977 58 pages A Hardware Implementation of the ATCRBS Reply Processor Used in DABS	R. G. Nelson J. H. Nuckols (See Ref. 629)
FAA-RD-77-134	ATC-81	7 November 1977 32 pages Uplink Coverage Measurements in the Los Angeles Area for Passive BCAS	F. Nagy, Jr. (See Ref. 574)

499. Massachusetts Institute of Technology (MIT) Lincoln Laboratory

Technical Notes

Discrete Address Beacon System (DABS) Documents

ESD-TR-72-381	1972-38	4 December 1972 86 pages The Use of Supplementary Receivers for Enhanced positional Accuracy in the DAB System	E. J. Kelly AD756843
ESD-TR-73-66	1973-7	9 February 1973 10 pages A Maximum-Likelihood Multiple-Hypothesis Testing Algorithm, with an Application to Monopulse Data Editing	E. J. Kelly AD756844
ESD-TR-73-344	1973-44	18 December 1973 68 pages Azimuth-Elevation Estimation Performance of a Spatially Dispersive Channel	T. P. McGarty AD773426
ESD-TR-73-253	1973-48	26 September 1973 37 pages An Optimum Interference Detector for DABS Monopulse Data Editing	R. J. McAulay T. P. McGarty AD769337
ESD-TR-74-40	1974-7	25 February 1974 156 pages Models of Multipath Propagation Effects in a Ground-to-Air Surveillance System	T. P. McGarty AD777241

ESD-TR-74-134	1974-12	12 March 1974 30 pages False Target Elimination at Albuquerque Using ARTS-111 Software		A. G. Cameron AD776798
ESD-TR-75-224	1975-6	17 July 1975 93 pages Effects of Local Terrain and Obstacles Upon Near Horizon Gain of L-Band Beacon Antennas		A. Spiridon AD-A013732
ESD-TR-75-145	1975-11	25 March 1975 166 pages The Statistical Characteristics of Diffuse Multipath Radiation and Its Effect on Antenna Performance		T. P. McGarty AD-A009869

500. Massachusetts Institute of Technology. Lincoln Laboratory

Development of a Discrete Address Beacon System. Quarterly Technical Summary 6.

Contract DOT-FA72WAI-261 FAA Report RD-73-101 July 1, 1973 102p. AD 766 601

Included in this report are the results of system design studies pertaining to the impact of locating IPC computation at the DABS sensor.

501. Massachusetts Institute of Technology, Lincoln Laboratory

Developments of a Discrete Address Beacon System Quarterly. Technical Summary 13

Contract DOT-FA72WAI-261 Project No. 034-241 012 FAA Report RD 75-67 April 1975 80p. AD-A010 441 N75-33025

In December 1974, the FAA requested that Lincoln Laboratory study the concept of a beacon-based, airborne collision-avoidance system. This system was to make use of active airborne interrogators and thus operate completely independently of the ground ATC system. The study was to focus on the ability of the beacon data to provide surveillance inputs to CAS threat evaluation and escape maneuver logic. The results of the Lincoln Laboratory study are summarized in section B of this report.

503. Massachusetts Institute of Technology, Lincoln Laboratory

Development of a Discrete Address Beacon System. Quarterly Technical Summary 18

Contract DOT-FA72WAI-261 FAA Report RD 76-126 July 1, 1976 46p.
AD-A030 368

This 18th Quarterly summarizes the status of Lincoln participation in a BCAS design definition working group and notes a potentially serious high-interference environment for which characterizing data are not yet available.

503. Massachusetts Institute of Technology, Lincoln Laboratory

Development of a Discrete Address Beacon System. Quarterly Technical Summary 19.

Contract DOT-FA72WAI-261 FAA Report RD-76-174 October 1, 1976 70p.
AD-A035 104

This QTS briefly reviews the objectives of the subject-pilot tests for IPC and details the functioning of active BCAS airborne equipment.

504. Maule, R.M.G.

Collision Avoidance Systems.

Tech Air vol. 28, p. 2, 3, March 1972

Lists five criteria which any collision avoidance system should meet. A collision threat evaluation is considered together with current collision avoidance systems, and collision avoidance maneuvers.

505. Maxey, E. Stanton

Collision Avoidance.

Aviation Week & Space Technology vol. 107, no. 7, p. 68, August 15, 1977

Letter in reply to those of A.D. McComas (Aviation Week June 27, p. 94) and Litchford's response (AW&ST July 25, p. 66). Dr. Maxey makes the following statement: "The fact that Dr. Koenke's 1971 technical report developed the logic whereby microcomputers could generate consistent alarms and evasive maneuver commands for such an onboard CAS leads clearly to the question of whether or not the crucial hurdle to an effective system isn't political and beaurocratic."

506. Maxwell, Robert L.

The Advanced Air Traffic Management System Study.

International Air Transport Association, 19th Technical Conference, Dublin, October 28, 1972. Montreal, Canada, IATA, n.d. WP-16 34p.

This paper reviews the reasons for the study, the goals of the advanced system, and the study approach. The assumptions used in the demand analysis for the 1995 time period are summarized, and the operational and control concepts visualized for this system are described. The ATM system should be designed to provide the necessary safety level of separation assurance without the airborne CAS. Since ATM is responsible for separation, it has been deemed unacceptable to relegate this function to the cockpit as the basic means of separation assurance. However, there may be a role for airborne spacing control with ground-based surveillance.

507. Maynard, J.A.

Aircraft Collision Prevention in Highly Dense Environments.

Navigation vol. 18, no. 4, p. 409-416 Winter 1971-1972

This paper reviews some of the statistics describing the problem of midairs, some of the efforts in process to solve it, gives a case example of a special situation solution, and suggests a plan to develop a total solution.

508. Maynard, Tom

Conflict Alert.

TAC Attack vol. 17, p. 26-27 May 1977

509. Meilander, W.C.

Ground Based Collision Avoidance.

Journal of Air Traffic Control vol. 14, no. 6, p. 24-25, November-December 1972

In: A Compilation of Presentations Made at the Air Traffic Control Association 17th Annual Meeting and Technical Program, 9-11 October 1972, Hotel Ambassador, Chicago, Illinois. p. 41-42

Describes methods for performing the ground based collision avoidance function. These procedures were demonstrated by Goodyear Aerospace either as part of the Knoxville experiments or at the TRANSPO exposition at Dulles International Airport. Development of improved tracking algorithms to further improve the conflict prediction and resolution performance is proceeding as part of Goodyear Aerospace's continuing program of improving the performance of ground based CAS.

510. Meilander, Willard C.

Ground Based Collision Avoidance.

The Controller, vol. 12, no. 4, p. 39-40, November 1973

Methods for performing the ground based collision avoidance function are described. The real problem for both ground CAS seems to be one of maintaining assured separation.

511. Melanson, David

Simulator Evaluation of Pilot Assurance Derived from an Airborne Traffic Situation Display. Phase II. Traffic Awareness Improvement.

Massachusetts Institute of Technology, Lincoln Laboratory Contract FA71WAI-234 FAA Report EM 74-10 July 1973 241p. AD 788 951 N75-13522

The research program described evaluated the pilot assurance derived from an Airborne Traffic Situation Display (ATSD), assurance being defined in terms of the pilot's awareness of his traffic environment. A pilot's ability to detect and react to conflict situations was measured during both single and parallel runway operations. The effects of conflict alarms and the frequency of updating information were also examined. All experiments were conducted in a fixed-based simulator configured as a Boeing 707.

512. Merz, A.W.

Optimal Aircraft Collision Avoidance.

In: Joint Automatic Control Conference, 14th, Columbus, Ohio, June 20-22, 1973, preprints of Technical Papers. N.Y., IEEE, 1973. p. 449-454

The coplanar two-aircraft encounter is modeled by assuming the speeds are constant and that the horizontal turn rates are the controls. The equations of relative motion are then of third order, and optimization theory is used to determine the turn rates such as to maximize the miss distance. Numerical results are presented for the case of two identical aircraft.

513. Meyer, Ernst

Airborne Proximity Warning Instrument Laboratory Tests.

Transportation Systems Center Report TSC-FAA-75-9 (FAA-RD 77-5) January 1977 18p. AD-A036 727

An Airborne Proximity Warning Instrument (APWI) designed and manufactured by Rock Avionics, New York, was subjected to a short laboratory test at TSC to determine the suitability of this product for further evaluation as an aid to visual detection of other aircraft. The test results were affirmative with regard to the parameters tested: namely, sensor pattern and freedom from false alarm. Sensitivity was tested only to ascertain the feasibility of field and/or flight tests.

514. Midair Collision.

Flight Safety Focus no. 6, p. 9-10, October 1972

Summarizes the NTSB report of the collision of an Eastern Air Lines McDonnell Douglas DC9-13 and a Cessna 206 while both were approaching Raleigh-Durham Airport runway on December 4, 1971.

515. Midair Collision Avoidance Technique.

Weekly Summary of Major Aircraft Accidents No. 47-72 (19-25 November 1972) p. 1, 4.

Summary of NTSB techniques for avoiding midair collisions.

516. The Midair Collision Near Nantes, March 5, 1973

Controller, vol. 14, no. 3, p. 44, August 1975

The French Commission of Inquiry has determined that the collision of two Spanish airliners -- an Iberia McDonnell Douglas DC-9-32 and a Spantax Convair 990-30A near Nantes resulted from a complex sequence of events dominated by poor communications, inadquate radio and radar facilities and confused ATC procedures.

517. Midair Collision Possibility Not A Threat, NASA Expert Says.

Aviation Daily vol. 234, no. 26, p. 207, September 7, 1977

Dr. Charles E. Billings, chief of the Aviation Safety Research Office of NASA, testified before the House Government Operations subcommittee on government activities and transportation, that "a great body of evidence indicate 'see and avoid' is an important aid in safety in all airspace. While near midair collisions occur with some frequency, actual midairs are rare, accounting for less than 1% of all aircraft accidents. There is quite a difference between statistics for near midairs and actual-collisions, and that is because pilots 'see and avoid' effectively. The system is a necessary backup to radar separation."

518. Midair Collision Risk Increases

Astronautics & Aeronautics vol. 11, no. 1, p. 14-15, January 1973

Looking ahead, NTSB fears that the midair-collision threat will tend to "increase in geometric proportion" to the expected growth in numbers and operations of aircraft.

519. Mid-air Collisions.

Flight Safety Focus no. 1, p. 12-14, January 1976

Brief reviews of three midairs: an USAF Convair and Cessna near Newport News, Va., January 1975; a Twin-Otter and a Cessna near Whittier, Calif., January 1975; and a F-111A fighter-bomber and a Rockwell Turbo Commander near Kingston, Utah in November 1974.

520. Midair Collision.

Flight Safety Focus no. 4, p. 11-15, June 1972

Review of NTSB Accident Report on the midair between Continental Air Lines Flight 712, Boeing 707-320C, on a regularly scheduled flight from Hilo, Hawaii to the Los Angeles International Airport, and a Cessna 150J. Cause was the minimum opportunity for the flightcrews to see and avoid the other aircraft due to the background lights behind the Cessna and the decrease in the Cessna pilots' visual field resulting from the aircraft's wing while turning.

521. Midair Collision Avoidance.

Weekly Summary of Major Aircraft Accidents No. 40-72 p. 1,3, (1-7 October 1972) OFFICIAL USE ONLY

Gives various reasons why the pilots of both aircraft could have seen each other in time to avoid collision -- if they had been looking and seeing (whether filed IFR or VFR).

522. Midair Collision Blamed On Visual Conditions.

Aviation Daily vol. 207, no. 20, p. 157, May 29, 1973

A fatal midair between a North Central 580 and an Air Wisconsin DHC-6 on June 29, 1972 has been attributed to aircraft crew's inability to see the other aircraft in time to begin evasive action, according to an NTSB report.

523. Midair Collision Near Whittier, California.

ATCA Bulletin no. 75-10, p. 3, October 1975

The failure of each flightcrew to see the other aircraft in time to take evasive action probably caused the midair collision of a commuter flight and a private aircraft near Whittier, California, January 9, 1975.

524. Midair Collision of an Eastern Air Lines McDonnell Douglas DC-9-31 and a Cessna 206.

National Transportation Safety Board SB72-46 June 19, 1972

The accident occurred near the Raleigh-Durham Airport on December 4, 1971. The Safety Board determined that the probable cause was. . . . "the inadequacy of air traffic control facilities and services in the Raleigh-Durham terminal area. The Board further determines that the relative flightpaths of the two aircraft and the configurations physically limited each flightcrew's ability to see and avoid the other aircraft."

525. Midair Collision Prevention.

TIG Brief vol. 27, p. 13-14, April 25, 1975

526. Midair Statistics are 'Cheerless', Safety Board Says.

Aviation Daily vol. 201, no. 30, p. 246, June 12, 1972

There were 27 collisions and four serious near-collisions in 1969, 37 collisions and one serious near-collision in 1970 and 32 collisions and one serious near-collision in 1971.

527. Midairs Are Evidence of Negligence.

Business & Commercial Aviation vol. 32, no. 2, p. 30, February 1973

Pilots involved in a midair at Oakland airport on February 17, 1967 were each found guilty of negligence per se in violation of FAR 91.65(a) which prohibits the operation of "an aircraft so close to another aircraft as to create a collision hazard".

528. Miles, W.B.

SECANT -- A Solution to the Problem of Mid-air Collisions.

Navigation vol. 19, no. 4, p. 363--376, Winter 1972-1973

SECANT helps the pilot to avoid mid-air collisions by transmitting probes and receiving replies with a 1 μs pulse up to 1000

pulses/s on 24 different frequencies. Various discriminants are used to eliminate undesired signals, and the false alarm rate is near zero.

529. Miles, W.B.

SECANT -- A Solution to the Problem of Mid-air Collisions.

Institute of Navigation, Annual Meeting, 28th, U.S. Military Academy, West Point, N.Y. June 27-29, 1972, Paper. 11p.

Description of the principal characteristics of SECANT, a system for the separation and control of aircraft using nonsynchronous techniques. The capabilities of each of the following modular equipments are discussed: remitter, proximity warning indicator, vertical escape collision avoidance system, vicinity traffic finder, collision-avoidance system, and traffic-monitoring system. The correlator, which transmits a randomly selected frequency probe and, when a corresponding frequency probe is received, retransmits an appropriate reply, is described.

530. Miller, Barry

USAF Studies NAVSAT Proposal.

Aviation Week & Space Technology vol. 96, no. 19, p. 50-51, 53, 56-57, May 8, 1972

Demonstration satellite navigation system is under review by Air Staff as intermediate step toward future capability. It is the multi-faceted 621B navigation satellite program, conducted by the SAMSO.

531. Miller, H.G.

Analysis of Enroute Metering Concepts.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-7002 August 1975 47p.

This study analyzes, via simulation, various enroute metering concepts with respect to providing meaningful benefits to the terminal area. The scope of the study was to determine the effect of the respective enroute metering concepts on the efficiency of operation in the terminal area. The criteria for measuring performance were reduction in fuel consumption, reduction in the number of aircraft simultaneously in the terminal area, reduction in the percentage of aircraft requireing terminal hold, and the number of cumulative landings.

532. Miller, Ken

Statement of the president of Wilcox Electric, Inc., Kansas City, Mo. with an attachment "Design Proposal for Low Cost 'Mini-CAS' for General Aviation."

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972, p. 28--75

"Wilcox knows without any question, that technology presently exists which will allow aviation equipment companies to develop, design, manufacture, and market time frequency collision avoidance equipment which aircraft operators and owners can well afford, thereby eliminating the need for PWI."

533. Millhollon, A.

Summary of Air-to-Air Visual Detection Data.

In: Control Data Corp. Air-to-Air Detection Data. Part 1. FAA-RD-73-40 April 1973 8p. N73-22145

An analysis of tests conducted to determine the ability of pilots to visually identify aircraft in an air-to-air situation in time to take evasive action. Specific cases of near collisions are cited to show the feasibility of collision avoidance by visual perception.

534. Millhollon, A., Lyons, J., and Graham, W.

Air-to-Air Visual Detection Data.

Control Data Corp. Contract FA70WA-2263 Interim report FAA-RD-73-40 April 1973 38p. N73-21145

Since the pilot is required to visually detect potentially hazardous intruders in the Pilot Warning Instrument (PWI) concept, the question of pilot air-to-air visual detection is critical. The significant conclusion from the data presented is that under good Visual Flight Rule (VFR) conditions, if the pilot is given accurate information on the location of intruding aircraft he has a high likelihood of seeing the intruder in sufficient time to take any required evasive action. This report presents two Control Data Corp. (CDC) papers summarizing data from two different air-to-air visual detection activities.

535. Milosevic, L.

The CNI Integrated System in Air Navigation.

Navigation (Paris) vol. 24, p. 381-406 October 1976 In FRENCH.

Feasibility of transition to an integrated air navigation, air-ground control communications, and collision avoidance system is discussed, along with the limitations of existing systems, features of new improved systems, and the integrated SINTAC (integrated navigation, telecommunications, and anticollision system) arrangement. Minimization of garbling and clutter overload and probabilities of uncluttered and ungarbled communications in high-density traffic are dealt with. The ADSEL (selective addressing), DABS (discrete address beacon), and AGDLS (air ground data link) systems and the ACAS collision avoidance system, and also RNAV area nabigation, are described and compared to SINTAC. SINTAC components and subsystems are outlined, and its adaptability to light aircraft is pointed out.

536. Milosevic, [L.] and Mollie, P.

Integration of functions of Communication, of Navigation, of Identification, and of Control of Traffic.

Navigation (Paris) vol. 22, p. 398-412, October 1974 In FRENCH.

The problems actually set by the functions of communication, navigation, identification (CNI) (saturation, proliferation of antennas and of equipment, operational insufficiency) impose study of solutions in the sense of integration rather than in the individual evolution of each equipment. Several degrees of integration are examined to arrive at the most perfect integration which the time-frequency systems offer. After having passed in review the way by which the time-frequency systems realize each CNI function, the economic aspect is developed of the replacement of equipments separated by an integral time-frequency system, involving or not the functions of landing and anticollision, in comparing in relative values the cost of equipments mounted on the aircraft.

537. Milosevic, Lj and Mollie, P.

Integration of Communication Functions, Integration, Identification and Traffic Control.

AGARD CP-105 Air Traffic Control Systems. Papers presented at the 14th Meeting of the Guidance and Control Panel of AGARD held in Edinburgh, Scotland, 26-29 June 1972. 11p. In FRENCH

The economic aspects of replacing separate aircraft landing and anticollision equipment with an integrated time-frequency system are discussed in detail. A comparison was also made of the relative cost value of replacing equipment mounted on the aircraft.

538. Milosevic, Ljubimko

Integrated Navigation System: Multifunction.

In: Plans and Developments for Air Traffic Systems. Papers presented at the 20th Symposium of the Guidance and Control Panel, held in Cambridge, Massachusetts, 20-23 May 1975. AGARD Conference Proceedings No. 188. Paper No. 19 43p. In ENGLISH and FRENCH

The multifunction integrated navigation system is designed in an homogeneous manner for radio navigation aid functions. It carries out navigation, surveillance with identification, anti-collision, data transmission and voice communications functions. It is compatible with either direct ground to air transmission links or indirect satellite transmission links. It significantly simplifies aircraft equipment. It features modular extensible design and it is practically a non-saturable system. Two overall views of the system utilization are either with enroute T/R ground stations or using satellites to cover the enroute space.

539. Misidentification.

Flight Safety Focus no. 4, p. 8-10, June 1972

Review of NTSB Incident Report on Trans World Airlines Boeing 707 and an American Airlines Boeing 707 near miss at 35,000 near Philipsburg, Pa., on June 11, 1971. The fault lay with the radar controllers.

540. Misidentification Blamed in Air Crash.

Aviation Week & Space Technology vol. 105, no. 6, p. 57, 61-62, August 9, 1976; no. 7, p.56, 57, 59, August 16, 1976

NTSB report of the November 14, 1974, collision of an Air Force F-111A and a privately owned Rockwell Turbo Commander that killed the pilot of the private aircraft. The probable cause of this accident was the F-111A pilot's misidentification of the Turbo Commander as a refueling tanker with which he intended to rendezvous. Contributing to the misidentification was his failure to use prescribed procedures and techniques during rendezvous with a tanker aircraft for refueling. As a result of this accident, the board issued five safety recommendations dealing with: (1) air traffic separation procedures

in aerial refueling areas, (2) dissemination of information on aerial refueling track locations, and (3) revised military aircraft lighting requirements.

541. Mitre Corporation

ATC Performance Requirements for Developing Prototoype Versions of the Discrete Address Beacon System.

Contract DOT-FA70WA-2448 FAA Report EM-73-6 (MTR-6321) April 1973 74p.

The requirements for the DABS which is to support the ATC System through the 1990's are enumerated. Data link requirements have been developed for several categories of messages. The first category is tactical (numeric), which are essential for ATC. Some of these messages are used to support such ATC services as: parallel-approach monitoring, improved metering and spacing, intermittent positive control and enroute monitoring.

542. Mitre Corporation

Engineering and Development Program Plan: Concepts, Design, and Description for the Upgraded Third Generation Air Traffic Control System.

Contract DOT-FA70WA-2448 FAA Report ED-01-1A (MTR-6152 Rev. 1) August 1972 141p. N73-14698

The Air Traffic Control system for the next 10 to 20 years is described. The design of the system is based upon significant improvements in the third generation ATC system now being deployed. Key features are (1) Metering and spacing automation, (2) intermittent positive control (IPC), (3) ATC data link services, (4) the discrete address beacon system (DABS). (5) the application of area navigation to ATC, (6) the microwave landing system (MLS), and (7) the application of satellites to oceanic ATC.

543. Mitre Corporation

An Overview and Assessment of Plans and Programs for the Development of the Upgraded Third Generation Air Traffic Control System.

Contract DOT-FA70WA-2448 FAA Report EM 72-5 (M73-237, Rev. 1) March 1975 225p.

The Intermittent Positive Control feature has been renamed Aircraft Separation Assurance and will incorporate efforts on airborne Collision Avoidance System (CAS). IPC is a feature

which will improve safety of flight and potentially reduce the number of midair airspace (some aircraft IFR, some VFR). Pilot warning advisories and collision avoidance commands will be generated on the ground and transmitted via data link to appropriately equipped aircraft. As the name implies, the ATC system will intervene only when necessary so that maximum freedom of flight can be maintained to the degree consistent with the safety of other users of the airspace.

544. Mobile Radar System Brings In The Helicopters.

Electronics vol. 46, no. 12, p. 62-63, June 7, 1973

SPARTIATE, a new highly-mobile surface-radar system designed specifically for helicopter control by Thomson-CSF, France. It's functions cover navigation control, collision avoidance identification, and landing.

545. Mohleji, S.C.

Automated Metering and Spacing with Area Navigation.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6431 June 14, 1973 44p.

This paper recommends metering and spacing area navigation procedures which are compatible with procedures for non-RNAV aircraft. A simulation using RNAV procedures was developed for Denver's Stapleton Airport and some fast-time simulation results are presented describing the performance of RNAV equipped aircraft in an automated metering and spacing environment.

546. Mohr, D.J.

Aircraft Transition Algorithm for Conflict Prediction, with Specific Reference to the North Atlantic Air Traffic Control System.

Toronto Univ., Institute for Aerospace Studies Report No. UTIAS-TN-183 January 1973 131p. AD 907 658 N73-17708

The purpose of this project was to extend presently available digital fast-time Air Traffic Control conflict prediction simulation models. A simulation algorithm was designed for compatibility with the Gander Automated Air Traffic System (GAATS) in cooperation with the Air Traffic Control Branch of the Ministry of Transport. The algorithm, intended for application to a multiple aircraft strategically controlled environment, functions to search, detect and resolve conflict situations during enroute aircraft transitioning. The simulation model includes meteorological data, route structure, flight trajectory construction, and a conflict resolution option.

547. Mohr, John L.

Collision Avoidance Ground Station Analysis.

McDonnell Douglas Electronics Company Contract FA73WA-3239 Report RD 74-44 March 1974 73p. AD 786 683 N75-12913

Three different collision avoidance system analyses were performed; ground station clock requirement, Loran-C accuracy and comparisons, and CAS monitoring requirements. Cesium beam standards are evaluated to determine their time accurancy, the number required to attain and maintain time to within 0.5 μs. The Loran-C system is reviewed to determine the potential time accuracy attainable by monitoring the Loran-C transmission. The results are then compared to the accuracy attainable from satellite, television, WWV and WWVB time transfer. The CAS equipment has certain built-in tests. These tests, as well as additional external monitors, are reviewed to categorize the test type and effectiveness.

548. Moreau, R.

Application of Ultrastable Oscillators to Aerospace.

Societe des Electriciens et Electroniciens, Journee d'Etude sur les Oscillateurs, Malakoff, Hauts-de-Seine, France, May 31, 1972. ONERA, TP no. 1114, 1972. 28p. In FRENCH

After recalling the main characteristics of the various kinds of ultrastable oscillators, mainly atomic clocks, the uses of these oscillations in terrestrial, maritime and aerospace applications are discussed, including hyperbolic navigation, geodesy, collision avoidance systems, trajectography, in particular around remote airfields, and analysis of radio-sources. The future of the time-frequency technique seems bright, especially in the following fields -- the use of geostationary satellites for worldwide precision navigation, military applications, space shuttle approach and landing, relativistic studies, and lastly airborne integrated safety and navigation systems built around the atomic clock. (Author)

549 Moreau, Roland

Conflict and Collision Avoidance Systems.

In: AGARD A Survey of Modern Air Traffic Control. AGARD AG-209 vol. 1 p. 203 - 238 July 1975 N75-32047

Greater flight safety dispite the growth in traffic by improved air traffic control was investigated. The means of ensuring

greater safety for successive phases of a flight from takeoff to landing, airborne collision avoidance systems (CAS) and ATC/CAS compatibility are discussed.

550. Moreau, Roland

A French Collision-Avoidance System of Time Frequency Type -- Critical Analysis of Test Results.

In: AGARD CP-105 Air Traffic Control Systems. Papers presented at the 14th Meeting of the Guidance and Control Panel of AGARD held in Edinburgh, Scotland, 26-29 June 1972. Paper 24-1 to 24-9. In FRENCH

NATO, AGARD, Reunion sur les Systems de Controle du Trafic Aerien, Edinburgh, Scotland, June 26-29, 1972. ONERA, TP no. 1086 (1972) 10p. In FRENCH

A collision-avoidance system of the time-frequency type, compatible with the American standards proposed by ARINC was studied at ONERA (The French Aerospace Research Institute), in collaboration with an industrial firm. A prototype was built and flight-tested for eighty hours, on a DC-7 aircraft of the Bretigny French Flight Test Center. The principle of operation is first recalled, and the device is briefly described. The means of control of the device is also outlined, and the results of flight tests are presented. The precision obtained is analyzed, both in comparison with that set by the standards, and with that which appears desirable. Modifications of the signal format are discussed. It is shown how the collision avoidance function might be fulfilled in the future as a subsystem of an integrated instrumentation designed around an onboard ultrastable oscillator.

551. Morgan, Harry T. and Moss, Arthur R.

Airspace Configuration and Separation Evaluation: Configuration and Procedures. Terminal ATC Digital Display System Errors, ARTS III.

FAA, NAFEC Report RD 76-178 (NA 76-6) November 1976 167p.
AD-A034 494 N77-21069

The major position and separation errors associated with the digital data provided to the radar controller by ARTS III are quantitatively assessed to provide the basis for specifying the air traffic control separation minima in ARTS-controlled airspace.

552. Moser, Royce

Aeromedical Factors in Midair Collisions.

School of Aerospace Medicine SAM Review 2-73 (SAM-TR-73-7) March 1973 21p. AD-758 189 N73-23005

Midair collisions continue to be a serious hazard in Air Force flight operations. Various aeromedical factors affect one's ability to detect another aircraft in time to avoid a collision. The review discusses these factors and illustrates the role of these factors in accident. It also considers the actions the crewmember should take to obtain the maximum benefit from the capabilities he does possess and thus reduce the risk of a midair collision.

553. Moss, Frank E.

Congressmen Speak Out on Collision Avoidance.

Air Line Pilot vol. 44, no. 2, p. 10, 11, 44, February 1974

Senator from Utah spoke about the lack of a collision avoidance system for aircraft.

554. Moss, Frank E.

Midair Collision Avoidance Act of 1973.

U.S. Congress, 93rd, 1st Session, Senate Bill 1610, April 17, 1973. 5p.

A Bill to amend the Federal Aviation Act of 1958 to require the installation of airborne, co-operative collision avoidance systems on certain civil and military aircraft, and for other purposes.

555. Moss, Frank E.

Statement of the U.S. Senator from Utah.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 6-12.

He insists that the FAA has the duty and responsibility to move forward now with resolve and determination to evaluate and set standards for collision avoidance.

556. Moss, Goldwater Ask for Mandatory Anticollision Devices on Aircraft.

Aviation Daily vol. 206, no. 6, p. 284, April 19, 1973

Both men have introduced bills to force FAA to require all commercial and military aircraft to install collision avoidance equipment by mid-1976.

557. Mosteller, Dee

How to Avoid a Midair Collision.

AOPA Pilot vol. 16, no. 1, p. 49-56, January 1973

This paper has been condensed from the AOPA Air Safety Foundation's Scan Training Program -- a uniquely different safety training film that presents, for the first time, a means for the nation's pilots to visually experience the most effective technique for scanning the skies for other traffic.

558. Muller, W.G. and Crush, J.F.

Low Cost Air Traffic Control (LCTC) Experiment.

Hazeltine Corporation Contract No. F33615-71-C-1898 Report No. AFAL-TR-72-425 February 1973 70p.

This report describes the first phase of an Air Force program to provide for the integration of existing equipments for flight testing and experimental evaluation of a simplified air surveillance tracking and collision avoidance system. The results to be derived from the flight tests are intended to demonstrate the feasibility of a LCTC System for airborne vehicles.

559. Mundra, A.

Air Traffic at an Uncontrolled Airport and Expected Alert Rates for Collision Detection Logics.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM 76-5 (MTR-7204) June 1976 81p. AD-A029 973

To provide preliminary design data for refinement of the Automated Terminal Services (ATS) concept, a study of airport traffic was initiated. Data was acquired on aircraft behavior in a typical traffic pattern at Manassas Airport: an uncontrolled, primarily general aviation airport. A time step computer model of the multi-aircraft traffic situation was generated. Various statistics of the traffic were extracted and potential collision warning logics exercised to determine alarm rates.

The results have implications for both the effectiveness of airborne collision avoidance systems in the traffic pattern and of ground based concepts that include threat detection such as ATS.

560. Mundra, A., Horowitz, B., and Dellon, F.

Sensitivity of IPC Performance to Variations in Surveillance Accuracy and Data Rate.

Mitre Corp. Contract DOT-FA70WA-2448 Report MTR-6541 January 4, 1974 65p.

Four second and ten second scan times were simulated. Two studies were performed. The first dealt only with the IPC tracker and produced measures of tracker heading error in straight flight and during turns. The second simulated a complete IPC system operating on two-aircraft conflicts and was used to normalize the actual minimum separations for the resolutions generated by the IPC system for the different surveillance performance characteristics by changing the protection volumes. Graphical results are presented along with conclusions about the effect of surveillance performance on IPC.

561. Mundra, Amand D.

Implications of Altimetry System Errors for Collision Avoidance Systems.

Mitre Corporation, METREK Division Contract DOT-FA70WA-2448 Technical Report MTR-7232 May 1977 85p.

The report compiles raw data gathered in flight tests conducted by FAA, NAFEC. The compilation yields histograms of the errors in automatically reported altitude and errors in indicated altitude for General Aviation. The impact of the errors in reported altitude on expected alert rates for the two automatic separation assurance systems currently being considered by the FAA, Intermittent Positive Control (IPC), and Beacon-based Collision Avoidance System (BCAS) are analyzed. It is shown that acceptable separation service in both IPC and BCAS is feasible with a threshold criterion of vertical coincidence which is less than 500 ft. Supplementary information in the appendices includes a comprehensive analysis and explanation of altimetry errors and a literature survey for estimates of air carrier errors.

562. Musillo, Anthony J.

Flight Test and Evaluation of Collision Warning Devices.

Army Electronics Command Report No. ECOM-4040 October 1972 75p.
AD 906 493L (USGO)

563. NBAA Policy: Aircraft Separation Assurance.

Flight Operations vol. 66, no. 12, p. 29, December 1977

NBAA believes that demands to be generated by increasing air traffic into the 1980's require a long range answer to the in-flight collision hazard question. This lists the nine (9) point policy of the association.

564. NTSB Again Challenges See-and-Avoid.

Aviation Week & Space Technology vol. 97, no. 4, p. 49, July 24, 1972

Brief review of NTSB findings regarding the midair between the American Airlines Boeing 707 and a Cessna 150 on January 9, 1971.

565. NTSB Analyzes California Collision.

Aviation Week & Space Technology vol. 105, no. 14, p. 62-65, October 4, 1976

Report on the midair collision of a Cessna 150 and a deHaviland Twin Otter over Whittier, Calif., January 9, 1975. All 14 persons in the aircraft were killed in the accident. The probable cause was the failure of both flight crews to see the other aircraft in sufficient time to initiate evasive action. The board was unable to determine why each crew failed to see and avoid the other aircraft; however, the board believes that the ability of both crews to detect the other aircraft in time to avoid a collision was reduced because of the position of the sun, the closure angle of the aircraft, and the necessity for the Twin Otter's flight crew to acquire visual contact with radar-reported traffic directly in front of them.

566. NTSB Blames Control System In Midair Collision.

Aviation Daily vol. 202, no. 6, p. 44, July 11, 1972

Probable cause of the January 9, 1971 midair collision near Newark, N.J. Airport involving an American 707 and a Cessna 150 trainer was "inability of the crews of both aircraft to see and avoid each other while operating in a system which permits VFR aircraft to operate up to 3,000 feet on random headings and altitudes in a congested area under conditions of reduced visibility." NTSB has recommended that FAA reevaluate VFR rules and procedures, especially as they apply in high-traffic areas. Other causal factors in the accident "were the deviating

of the air carrier airplane from its clearance altitude and the conducting of student flight training in a congested control area under marginal flight visibility conditions."

567. NTSB Blames Lack of Crew Vigilance in Near Collision.

Aviation Daily vol. 204, no. 30, p. 239, December 13, 1972

Lack of visual scanning vigilance on the part of both-flight crews as the probable cause of a near collision on April 26, 1972 near Front Royal, Va., between a Northwest 720B and a Convair 240.

568. NTSB Cites Pilot Error In Midair Collision.

ATCA Bulletin No. 75-10, p. 3, October 1975.

A night midair collision which killed Butte pilot Rocco Fiori, November 12, 1974, near Kingston, Utah, occurred when an Air Force F-111 fighter-bomber pilot mistook Fiori's aircraft for the tanker plane with which he was to rendezvous for a midair refueling, the NTSB said. The Board cited Captain Peter Granger, pilot of the F-111, for failure to use procedures prescribed for his refueling as contributing to the misidentification.

569. NTSB Details Lightplane, F-106 Collision.

Aviation Week & Space Technology vol. 102, no. 19, p. 55, 58-59, May 12, 1975

Gives report on the midair collision of a New Jersey Air National Guard Convair F-106 and a Piper PA24-250 near Saxis, Va., October 11, 1974, in which four persons died. Recommendations of NTSB to FAA are given.

570. NTSB Faults 'See and Avoid' Concept in Midair Collision Investigation.

Aviation Daily vol. 204, no. 22, p. 173, December 1, 1972

The probable cause of the midair of a Hughes Airwest DC-9 and a Marine F-4B Phantom fighter near Duarte, Calif., was "the failure of both crews to see and avoid each other".

571. NTSB Says Not All Safety Recommendations Acted On By FAA.

Aviation Daily vol. 201, no. 30, p. 246, June 12, 1972

NTSB reported in its annual report to Congress that it has been unable to get FAA to act on several of its 70 safety recommendations made in 1971.

572. NTSB: 78% of Midair Collisions Could Have Been Avoided.

Aviation Daily vol. 203, no. 18, p. 143, September 27, 1972

National Transportation Safety Board, in the latest segment of a study of midair collisions, said 78% of 102 midair accidents during 1968-1970 "could have been avoided by the see-and-avoid concept if the aircrews had conformed to the existing flight rules, followed sound cockpit procedures, and if the aircraft involved had been more conspicuous." Lists recommendations and actions urged by NTSB to reduce midair crashes.

573. NTSB Studies Michigan Near-Midair.

Aviation Week & Space Technology vol. 104, no. 15, p. 59-61, 63, 64, April 12, 1976

Report of near-midair on November 26, 1975 between American Airlines McDonnell Douglas DC-10 and a Trans World Airlines Lockheed L-1011 at 35,000 near Carleton, Michigan. Both aircraft were operating in instrument meteorological conditions, within positive control of the Cleveland ARTCC. As a result of an evasive maneuver that had to be executed by the captain of the DC-10, three passengers were injured seriously and 21 injured slightly. The probable cause of this near-collision was the failure of the radar controller to apply prescribed separation criteria when he first became aware of a potential traffic conflict which necessitated an abrupt collision avoidance maneuver. He also allowed secondary duties to interfere with the timely detection of the impending traffic conflict when it was displayed clearly on his radarscope. Contributing to the accident was an incomplete sector briefing during the change of controller personnel -- about 1 min. before the accident.

574. Nagy, F., Jr.

Uplink Coverage Measurement in the Los Angeles Area for Passive BCAS.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA77-WAI727 FAA Report RD 77-134 (ATC-81) November 7, 1977 32p.

Uplink (1030 MHz) measurement results are presented, based on data recorded by the Airborne Measurement Facility of the M.I.T. Lincoln Laboratory during normal landings and take-offs at LAX, Van Nuys, and San Diego airports. The data presented are relevant to current investigations of passive beacon-based collision systems and include: (1) the interrogator environment as received; (2) its division between FAA and other interrogators; (3) its dependence on aircraft height during landings and take-offs; and (4) the availability P2 pulses of sufficient strength for PRF (pulse repetition frequency) tracking. (Author)

575. National Aeronautics and Space Administration, Ames Research Center

NASA Aviation Safety Reporting System. Quarterly Report 15 July -- 14 October 1976. Prepared in cooperation with Battelle's Columbus Labs.

NASA-TM-X- 3494 December 1976 68p. N77-16002

During the second quarter of the Aviation Safety Reporting System (ASRS) operation 1,497 reports were received from pilots, controllers and others in the national aviation system.

576. National Aeronautics and Space Administration, Ames Research Center

NASA Aviation Safety Reporting System; Quarterly Report, 15 October 1976 -- 14 January 1977.

NASA-TM-X-3546 May 1977 74p. N77-24076

During the third quarter of operation of the Aviation Safety Reporting System (ASRS), 1429 reports concerning aviation safety were received from pilots, air traffic controllers, and others in the national aviation system. Details of the administration and results of the program are discussed. Altitude deviations and potential aircraft conflicts associated with misunderstood clearances were studied and the results are discussed.

577. National Aeronautics and Space Administration, Ames Research Center

NASA Aviation Safety Reporting System: Fourth Quarterly Report, January 15, 1977 -- April 14, 1977.

NASA TM-78,433 October 1977 87p.

During the fourth quarter of ASRS operations, 1325 reports were received. A decline in reports concerning small aircraft was noted; more reports involved transport aircraft, professional pilots, instrument meteorological conditions, and weather problems. A study of 136 reports of operational problems in terminal radar service areas was made. Information transfer difficulties were prominent. Misunderstandings by pilots, and in some cases by controllers, of the policies and limitations of terminal radar programs were observed.

578. National Transportation Safety Board

Aircraft Accident Preliminary Report -- North Central Airlines, Inc./ Air Wisconsin, Inc. CV-580, N90858/DHC-6, N4043B Midair Collision Near Appleton, Wisconsin, June 29, 1972.

Attachment to: NTSB Safety Information Release SB 72-74/920 August 30, 1972. 6p. N72-30970

The accident was fatal to 13 persons. Both aircraft appeared to be in level flight until an instant before impact, at which time Flight 671 appeared to attempt an evasive maneuver.

579. National Transportation Safety Board

Aircraft Accident Report -- American Airlines, Inc., Boeing 707-323, N7595A and a Linden Flight Service, Inc., Cessna 150, N60942 Over Edison, New Jersey, January 9, 1971.

Report No. NTSB-AAR-72-16 May 10, 1972 16p. N74-29381 N72-27025 PB-234 423

NTSB determined that the probable cause of the midair collision was the inability of the crews of both aircraft to see and avoid each other while operating in a system which permits VFR aircraft to operate up to 3,000 feet on random headings and altitudes in a congested area under conditions of reduced visibility. Other causal factors were the deviation of the air carrier airplane from its clearance altitude and the conducting of student flight training in a congested control area under marginal flight visibility clearance.

580. National Transportation Safety Board

Aircraft Accident Report: Continental Air Lines, Incorporated, Boeing 707-320C, N47330 and Floyds Flying Service, Cessna 150J, N61011. Compton, California, August 4, 1971.

Report No. NTSB-AAR-72-5 December 29, 1971 14p. N72-22016

Report of a midair collision. Both aircraft landed safely and injuries occurred only to the two persons in the Cessna aircraft. Cause of the accident was due to atmospheric lighting conditions which reduced the visibility range and blanking of the Cessna pilot's vision by the wing of the smaller aircraft.

581. National Transportation Safety Board

Aircraft Accident Report: Eastern Air Lines, Inc. McDonnell Douglas DC-9-31 N8943E, and a Cessna Model 206, N2110F, Raleigh-Durham Airport, Raleigh, North Carolina, December 4, 1971.

NTSB Report No. NTSB-AAR-72-13 April 5, 1972 15p. N72-26018 PB210 241

Eastern Air Lines, Inc., Flight 898 and a Cessna 206 collided in midair between the outer marker and the threshold of Runway 5

of the Raleigh-Durham Airport. Both aircraft were under the control of the Tower local controller. The cause was the inadequacy of air traffic control facilities and services in the terminal area. Also, the relative flighpaths of the two aircraft and the configurations physically limited each flightcrew's ability to see and avoid the other aircraft.

582. National Transportation Safety Board

Aircraft Accident Report: Golden West Airlines, Inc., DeHavilland DHC-6, N6383 and Cessnair Aviation, Inc., Cessna 150, N11421, Whittier, California, January 9, 1975.

NTSB Report AAR-75-14 August 7, 1975 24p. PB-245 583 N76-17080

Golden West Airlines, Inc., Flight 261, a De Havilland Twin Otter, and a Cessnair Aviation, Inc., Cessna 150 collided in flight near Whittier, California. The accident occurred during daylight hours, at approximately 4:07 p m., P.s.t., January 9, 1975. Both aircraft were destroyed by the collision and subsequent ground impact. The NTSB determined that the probable cause of the accident was the failure of both flightcrews to see the other aircraft in sufficient time to initiate evasive action.

583. National Transportation Safety Board

Aircraft Accident Report: Hughes Air West DC-9, N9345, and U.S. Marine Corps F-4B, 151458 Near Duarte, California, June 6, 1972.

NTSB Report Number AAR-72-26 August 30, 1972 38p., 4 attachments N73-12037 PB-212 987

The probable cause of this accident was the failure of both crews to see and avoid each other but recognizes that they had only marginal capability to detect, assess, and avoid the collision. Other factors involved included, a very high closure rate, comingling of IFR and VFR traffic in area where the limitation of ATC system precludes effective separation of such traffic, and failure of the crew of the F-4B to request radar advisory service and particularly considering the fact that they had an inoperable transponder. Four new recommendations are given.

584. National Transportation Safety Board

Aircraft Accident Report -- Midair Collision, Reeds Aviation, Inc., Piper PA-28R-200, N7941C and Piper PA-28-181, N8592C, near Huntsville, Missouri, July 24, 1976.

Report No. NTSB-AAR-77-2 April 14, 1977 24p. NTISUB/C/104-002

The collision occurred at 6,000 feet. Piper N8592C, a private flight operating under instrument flight rules and under the control of Kansas City air route traffic control center, was en route from Urbana, Illinois, to Emporia, Kansas. Piper N7941C, an air taxi/charter flight operating under visual flight rules and without a flight plan, was climbing en route from Salisbury, Missouri, to Chicago, Illinois, area. The probable cause of this accident was the failure of each pilot to maintain adequate vigilance.

585. National Transportation Safety Board

Aircraft Accident Report: Montana Power Company Rockwell Turbo Commander 690A, N40MP and USAF F-111A, 77-055 Near Kingston, Utah, November 12, 1974.

NTSB-AAR-75-12 August 1975 30p. PB-245 582

About 1804 m.s.t. the planes collided in flight near Kingston, Utah. The F-111A was lead aircraft in a formation of two F-111A's. The formation was attempting a rendezvous with a USAF KC-135 for night air refueling training when the planes collided. The two crewmembers of the F-111A ejected successfully from their aircraft, while the pilot of the N40MP was killed. NTSB determined the probable cause was the misidentification on the part of the F-111A pilot of the Turbo Commander, as well as his failure to use prescribed procedures and techniques during rendezvous.

586. National Transportation Safety Board

Aircraft Accident Report — Near Midair Collision, American Airlines, Inc., Douglas DC-10, N124, and Trans World Airlines, Inc., Lockheed L-1011, N11002, Near Carleton, Michigan, November 26, 1975

NTSB-AAR-76-3 January 28, 1976 23p. NTISUB/B/104-76/003

The two aircraft almost collided head-on at 35,000 feet near Carleton, Mich. Both aircraft were operating in instrument meteorological conditions, within positive control airspace, and while under the control of the Cleveland Air Route Control Center. As a result of the evasive maneuver executed by the captain of the DC-10, 3 aircraft occupants were injured seriously and 21 were injured slightly. The cabin's interior was damaged extensively. NTSB determines that the probable cause of this near-collision was the failure of the radar controller to apply prescribed separation criteria when he first became aware of a potential traffic conflict which necessitated an abrupt collision avoidance maneuver. He also allowed secondary duties to interfere with the timely detection of the

impending traffic conflict when it was displayed clearly on his radarscope. Contributing to the accident was an incomplete sector briefing during the change of controller personnel -- about 1 minute before the accident.

587. National Transportation Safety Board

Aircraft Accident Report -- New Jersey Air National Guard Convair F106, Serial Number 59-0044, Piper PA-24-250, N2876P, Midair Collision Near Saxis, Virginia, October 11, 1974.

NTSB-AAR-75-6 January 29, 1975 15p. PB-240 250/1 N75-26984

The NTSB determines that the probable cause of the accident was the failure of the interceptor pilot to see and avoid a civil aircraft during a high-speed, low-altitude, intercept training flight conducted in an area which included major north-south airways. Also contributing to this accident was the system which permitted an incompatible mix of traffic in controlled airspace which resulted in the probability of an inadvertent radar lock-on to a civil aircraft.

588. National Transportation Safety Board

Aircraft Accident Report - North Central Airlines, Inc., Allison Convair 340/440, N90858, and an Air Wisconsin, Inc., DHC-6, N4043B, Near Appleton, Wisconsin, June 29, 1972.

NTSB-AAR-73-9 April 25, 1973 33p. N73-26016 PB-221 042

Both aircraft were destroyed as a result of the in-flight collision and the subsequent water impact. Both aircraft were proceeding in accordance with visual flight rules and were within minutes of landing at their respective destinations. The probable cause of this accident was the failure of both flightcrews to detect visually the other aircraft in sufficient time to initiate evasive action.

589. National Transportation Safety Board

Aircraft Accident Report: Ruel Insurance Corporation Cessna 414, N8PR, and U.S. Air Force F-4E, 67-0255, Near Brighton, Florida, Septmenber 13, 1976.

Report No. NTSB-AAR-77-5 September 16, 1977 27p.

The collision occurred about 0954 e.d.t. in flight about 7 nmi south of Brighton, Florida. The F-4E was the No. 3 aircraft in a formation of three F-4E's which was descending to enter a restricted area for low-level gunnery practice. The planes

collided at 12,500 feet m.s.l. outside the boundries of restricted airspace. The pilot and three passengers onboard N8PR and a pilot onboard the F-4E were killed. The other pilot from the F-4E ejected successfully and escaped injury. The probable cause of this accident was the failure of the pilots of the F-4E's to maintain adequate vigilance in order to see and avoid the light aircraft.

590. National Transportation Safety Board

Aircraft Accident Report: Trans World Airlines, Incorporated, Boeing 707, N6729TW and American Airlines, Incorporated, Boeing 707, N8432, near Philipsburg, Pennsylvania. 11 June 1971.

Report No. NTSB-AAR-72-7 December 29, 1971 16p. N72-22017 PB-208223

The two planes narrowly avoided a midair collision at approximately 35,000 feet while operating within positive control airspace under the control jurisdiction of the New York Air Route Traffic Control Center. As a result of the violent evasive maneuver executed by the captain of the TWA B-707, three passengers and the flight engineer incurred minor injuries, but did not require immediate medical attention. The crew of the other plane was unaware of the occurrence at the time. NTSB determined that the probable cause of this incident was the controller's misidentification of the radar target of the flight 31 due to a transitory diversion of attention to another portion of the radar display. This resulted in inappropriate traffic control actions with respect to the American Airlines aircraft and placed the two flights on a collision course at the same altitude.

591. National Transportation Safety Board

Aircraft Accident Report -- USAF VT-29D, Serial No. 52-5826 and Cavalier Flyers, Inc., Cessna 150H, N50430, Newport News, Virginia, January 9, 1975.

NTSB-AAR-75-10 June 18, 1975 29p. PB-244 223

About 1836 e.s.t., on January 9, 1975, a United States Air Force Convair and a Cessna collided in flight over the James River near Newport News, Va., at an altitude of 1,500 ft. All aboard both planes were killed. Both aircraft were destroyed by the collision and subsequent impact with the water. The probable cause of this accident was the human limitation inherent in the see-and-avoid concept, which can be critical in a terminal area with a combination of controlled and uncontrolled traffic. A possible contributing factor was the reduced nighttime conspicuity of the Cessna against a background of city lights.

592. National Transportation Safety Board

Aircraft Incident Report — Near Midair Collision, Hughes Airwest, Douglas DC-9, N9333, and Northwest Airlines, Inc., Douglas DC-10, N148US, Spokane, Washington, April 1, 1976.

Report No. NTSB-AAR-76-18 August 18, 1976 22p. NTISUB/B/104-76/018

Hughes Airwest Flight 5 and Northwest Airlines Flight 603 almost collided in instrument meteorological conditions over Spokane International Airport. Airwest 5 exectued a missed approach from the ILS approach to runway 21 as Northwest 603 departed runway 21 and began its climb. Both aircraft continued in a south-southwesterly direction until the flightcrew of Airwest 5 saw Northwest 603 and took evasive action. Airwest 5 encountered the wake turbulence from Northwest 603 which rolled Airwest 5 into a 60° to 70° angle of bank, Its captain returned the aircraft to level flight and landed at Spokane. Northwest 603 continued to its destination. None of the 176 persons aboard the two aircraft were injured, and the aircraft were not damaged.

NTSB determined that the probable cause of this incident was the inadequacy of the local control procedures to insure positive and adequate separation between arriving and departing aircraft. Also contributing was the failure of the local controller to recognize and resolve the impending conflict in accordance with the basic mandate to insure positive separation between aircraft. Also contributing was the failure of the crew of Airwest 5 to follow company ILS approach procedures and the recommended FAA position reporting procedures.

593. National Transportation Safety Board

Aircraft Incident Report: Near Midair Collision Vicinity of Front Royal, Virginia, Northwest Airlines, Boeing 720B, N736US, Lockheed Aircraft Corporation, Convair 240, N7377 26 April 1972.

NTSB-AAR-72-30 October 26, 1972 16p. N73-12040 PB-213 233

It was determined that the probable cause of the accident was lack of visual scanning vigilance on the part of both flight crews to provide safe in-flight separation in visual flight rules conditions.

594. National Transportation Safety Board

Annual Review of Aircraft Accident Data, U.S. General Aviation, Calendar Year 1975.

NTSB-ARG-77-1 January 25, 1977 200p. PB-264 394 N77-25127

Statistical information compiled from reports of 4,237 general aviation accidents that occurred during the calendar year 1975 is presented. Included in the total number of accidents are 51 collisions between aircraft.

595. National Transportation Safety Board

Annual Review of Aircraft Accident Data, U.S. General Aviation, Calendar Year 1972.

NTSB-ARG-74-3 November 1974 207p. PB-239608 N75-26988

The Annual Review of Aircraft Accident Data is a statistical compilation from reports of 4,256 general accidents that occurred during the calendar year 1972. Also included are 44 collisions between aircraft.

596. National Transportation Safety Board.

Annual Review of Aircraft Accident Data: U.S. General Aviation Calendar Year 1971.

NTSB-ARG-74-2 May 1974 200p. N75-10037

This publication contains statistical information compiled from reports of 4,648 General Aviation accidents that occurred during the calendar year 1971. Included in the total number of accidents are 51 collisions between aircraft.

597. National Transportation Safety Board

Annual Review of Aircraft Accident Data. U.S. General Aviation, Calendar Year 1970.

NTSB-ARG-74-1 April 1974 170p. N74-25558

The Annual Review of Aircraft Accident Data is a statistical compilation published by the NTSB. The publication contains statistical information compiled from reports of 4,712 general aviation accidents that occurred during the calendar year 1970. Included in the total number of accidents are 63 collisions between aircraft.

598. National Transportation Safety Board

Briefs of Accidents Involving Midair Collisions, U.S. General Aviation, 1975.

NTSB-AMM-77-2 February 11, 1977 48p. PB-267 645

The publication contains reports on 29 accident files, 13 of which involve fatal accidents.

599. National Transportation Safety Board

Briefs of Accidents Involving Midair Collisions, U.S. General Aviation, 1974.

NTSB-AMM-75-13 December 1975 54p. PB-250 513

Listed in the general aviation midair collision accidents occurring in 1974 are 34 accident files, 19 of which involved fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident.

600. National Transportation Safety Board

Briefs of Accidents Involving Midair Collisions. U.S. General Aviation, 1973.

NTSB-AMM-75-2 June 18, 1975 43p. PB-244 521 N76-15129

Included are 24 accident files, 12 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable causes for each accident. Additional statistical information is tabulated by kind of flying, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factors. (GRA)

601. National Transportation Safety Board

Collision near Brighton, Florida, September 13, 1976.

Safety Recommendation A-77-9 and 10. February 16, 1977 2p.

A Cessna 414 and a U.S. Air Force F-4E Phantom II fighter collided in midair near Brighton, Florida, on September 13, 1976. The F-4E, one of a formation flight of three from Homestead Air Force Base, was on a composite IFR/VFR flight plan to Avon Park Restricted Area while the Cessna 414 was operating under VFR and the pilot had not filed a flight plan.

602. National Transportation Safety Board

Fatal Midair collision near Huntsville, Missouri.

Safety Information SB 77-20/1977A April 14, 1977 2p.

The fatal midair collision between two Piper aircraft which occurred near Huntsville, Mo., July 24, 1976, was probably caused by "failure of each pilot to maintain adequate vigilance".

603. National Transportation Safety Board

In-Flight Safety of Passengers and Flight Attendants Aboard Air Carrier Aircraft.

Special Study. Report No. NTSB-AAS-73-1 March 14, 1973 41p.
PB-220 374

This study examines nonfatal in-flight injuries of passengers and flight attendants in air carrier operations during the years 1968 through 1971. Injuries caused by turbulence, evasive maneuvers to avoid a collision, and self-initiated injuries are summarized. Conditions, circumstances, and pre-existing factors instrumental in creating a hazardous environment for persons aboard aircraft are examined, as well as types of injuries sustained and the treatment of such injuries. Also examined is the relationship of injuries to passenger seatbelt discipline, structure and design of cabin furnishings, flight attendants' duties, consumption of alcoholic beverages, and the location in the airplane of passengers and flight attendants. Six safety recommendations are presented.

604. National Transportation Safety Board

Investigation of a Fatal, Midair Collision.

Safety Recommendation A-74-97 November 14, 1974 1p.

The collision occurred between a New Jersey Air National Guard F106 and a civil aircraft on October 11, 1974 near Saxis, Va. NTSB recommends that controlled-airspace should not be used for military intercept training operations.

605. National Transportation Safety Board

Investigation of the Midair Collision Between a Cessna-150H and a USAF T-29D at Newport News, Virginia, on January 9, 1975.

Safety Recommendations A-75-35 thru 38 April 25, 1975 3p.

The Safety Board believes that this accident again points out the hazards of an IFR-VFR traffic mix, and the inadequacies of the "see and avoid" concept in terminal areas. Four recommended procedures are given, and if adopted, will lower the exposure rate of both military and civil-aircraft to the dangers of terminal-area midair collisions.

606. National Transportation Safety Board

Midair Collisions in U.S. Civil Aviation - 1969-1970 Special Study.

NTSB Report No. NTSB-AAS-72-6 June 7, 1972 72p. PB-211 906

A special accident prevention study which analyzes the commonality of midair collisions of aircraft and which updates the 1968 NTSB midair collision study, including a review of the 1969 and 1970 midair collision reports.

607. National Transportation Safety Board

(NTSB Announces the Probable Cause of a Fatal Midair Collision.)

Safety Information Release SB-77-40/1976A 3p.

The fatal midair collision involved a U.S. Air Force F4E jet and a twin-engine Cessna 414 civil aircraft that occurred south of Brighton, Florida, on September 13, 1976. The probable cause of the accident was the "failure of the pilots of REED 11 flight to maintain adequate vigilance in order to see and avoid the light aircraft."

608. National Transportation Safety Board

(Near Collision Near Carleton, Michigan.)

Safety Information SB 76-12/1736 February 25, 1976 3p.

A near collision between an American Airlines DC-10 and a Trans World Airlines Lockheed 1011 at 35,000 near Carleton, Michigan on November 26, 1975. Both were under the control of the Cleveland ARTCC. The board determined that the probable cause of this near-collision "was the failure of the radar controller to apply prescribed separation criteria when he first became aware of a potential conflict which necessitated an abrupt collision avoidance maneuver. He also allowed secondary duties to interfere with the timely detection of the impending traffic conflict when it was displayed clearly on his radarscope.

609. National Transportation Safety Board

(Near Collision Near Carleton, Michigan.)

Safety Recommendation A-76-3 February 25, 1976 2p.

On November 26, 1975, an American Airlines DC-10 and a Trans World Airlines L-1011 almost collided head-on at 35,000 feet near Carleton, Michigan. Both aircraft were operating under the control of the same sector of the Cleveland ARTCC. This accident shows that automation may lead to complacency because it reduces the degree of controller interaction with the flight-crew and deemphasizes the cooperative aspects of the air traffic system. NTSB recommends distribution of reports to all ATC'ers and discussion in their training programs.

610. National Transportation Safety Board.

Near Midair Near Appleton, Ohio.

Safety Recommendation A77-52 and 53 July 25, 1977 4p.

On November 17, 1976, TWA Flight 373 (a B727), and TWA Flight 516 (a DC-9), almost collided in midair near Appleton, Ohio. As a result of evasive action taken by the pilot of TWA 516, two crewmembers were injured. NTSB's investigation of the incident revealed that neither the flightcrew of TWA 373 nor the air traffic controller understood or heard correctly each other's message regarding altitude assignment. They recommend that a controller who issues an altitude assignment and/or a vector heading assignment to an aircraft in flight be required to request readback of the clearance if he does not receive one from the crew. Pilot acknowledgment without readback should not be accepted by the controller.

611. National Transportation Safety Board

News Release of Report on Near Midair Collision Near Front Royal, Virginia, April 26, 1972

NTSB Safety Information Release No. SB 72-104/974, December 8, 1972

Northwest Airlines Boeing 720B and a general aviation Convair 240. The probable cause of the incident was "the lack of visual scanning vigilance on the part of both flightcrews to provide safe in-flight separation while operating in VFR flight conditions."

612. National Transportation Safety Board

On April 1, 1976, Hughes Airwest Flight 5 and Northwest Airlines Flight 603 almost collided in midair over the Spokane International Airport.

Safety Recommendation A-76-91 and 92 July 15, 1976 2p.

Both flightcrews misunderstood the radar services being provided by Fairchild Air Force Base RAPCON and Spokane Tower. The Spokane Tower is not radar equipped and Fairchild RAPCON is capable only of providing limited, low-altitude radar coverage of the airport because of blind spots.

613. National Transportation Safety Board

Recommends Climb and Descent Corridors be Established Above the New Terminal Control Areas at the Nation's Largest Airports.

Safety Information Release No. SB 72-101/651B November 30, 1972 3p.

Report of collision between a Marine Corps F-4B "Phantom" and Hughes Airwest DC-9 at 15,150 feet near Duarte, Calif., on June 6, 1971. The probable cause was "the failure of both crews to see and avoid each other," although the Board recognized that each crew "had only marginal capability to detect the other, assess the hazard and avoid the collision. The causal factors cited by the Board were (1) "a very high closing rate" of about 770 mph; (2) comingling of IFR and VFR traffic in an area where the limitation of the ATC system precludes effective separation of such traffic", and (3) failure of the fighter's crew to request radar advisory service "Particularly considering" the inoperative transponder and the resulting significant reduction in the controllers' ability to detect the fighter on radar.

614. National Transportation Safety Board

Report on a Fatal Midair Collision Accident.

Safety Information Release SB 72 - 56, July 10, 1972

The accident involved an American Airlines 707 and a Linden Flight Service Cessna 150 which occurred over Edison, N.J. on January 9, 1971. As the result of this accident the Board recommended that the FAA "establish procedures" whereby all operators of civil flying training schools "formally advise" FAA of locations of designated practice areas and that such information be disseminated to all affected services within the FAA.

615. National Transportation Safety Board

Report on a Fatal Collision Accident Involving a North Central Airlines DC-9 and a Delta Air Lines CV-880 which occurred at the O'Hare International Airport, Chicago, Illinois on the night of December 20, 1972.

Safety Information Release SB 73-57/1081AB August 10, 1973 5p.

The Safety Board determined that the probable cause of this accident was the failure of the traffic control system to insure separation of aircraft during a period of restricted visibility.

616. National Transportation Safety Board

Report on the Fatal Midair Collision of a New Jersey Air National Guard F-106 Jet Interceptor Aircraft and a Piper PA 24-250 which Occurred Near Saxis, Virginia at 2023 EDT on October 11, 1974.

Safety Information Release SB 75-18/1407A March 19, 1975 3p.

The probable cause of this collision accident was the failure of the interceptor pilot to see and avoid a civil aircraft during a high-speed, low-altitude, intercept training flight conducted in an area which included major north-south airways. Also contributing to this accident was the system which permitted an incompatible mix of traffic in controlled airspace which resulted in the probability of an inadvertent radar lock-on to a civil aircraft.

617. National Transportation Safety Board

(Result of review of several recent ATC accidents and Incidents.)

NTSB Safety Recommendation A-76-58 March 31, 1976 2p.

Deficiencies in human performance were critical causal factors. Recommends a comprehensive study of the human failure of ATC system.

618. National Transportation Safety Board

Revision of the Accident Report on the Midair Collision of an American Airlines Boeing 707 and a Linden Flight Service Cessna 150 on January 9, 1971.

Safety Information SB 74-46/586B August 6, 1974 2p.

The revised report corrected the collision altitude to 2,975 feet, and eliminated the finding of deviation from the clearance altitude. The revision stated that there was no indication the flight instruction had "attempted to obtain available weather reports."

619. National Transportation Safety Board

Safety Information on Midair Collision Near Kingston, Utah, November 12, 1974.

SB 75-58/1468A September 15, 1975 2p.

An Air Force fighter-bomber pilot's mistaking a civilian aircraft for the tanker plane with which he was to rendezvous for a night midair refueling caused the midair collision near Kingston, Utah. The swing-wing F-111A fighter-bomber and the twin-engine Rockwell Turbo Commander 680 collided at 17,900 feet.

620. National Transportation Safety Board

Safety Recommendations to Administrator, FAA.

Flight Safety Facts & Reports Vol. 8, no. 7, p. 5-6, July 1977

At 1619 EDT on November 17, 1976, airline flights 373 (B-727) and 516 (DC-9) almost collided in midair near Appleton, OH. As a result of evasive action taken by the DC-9 pilot, two crewmembers were injured. The NTSB's investigation of the incident revealed that neither the flightcrew of the 727 nor the air traffic controller understood correctly each other's message regarding altitude assignment. Now the crew must give a readback of any altitude or vector heading assignments received from the controllers.

621. National Transportation Safety Board

17 Safety Recommendations.

NTSB Safety Information Release SB 72-86/786B September 21, 1972 3p.

Summarizes their report on collision avoidance statistics. Recommends 17 steps to be taken by government and industry.

622. Naval Air Test Center

Qualification Tests for Aircraft Lighting Equipment (Grimes Manufacturing Company, P/N 30-0837-5, S/N 7, Anticollision Strobe Light). (U)

Report NATC-WST-81R-74 August 1974 5p. AD 921 709L (USGO)

623. Naval Air Test Center

Qualification Tests for Aircraft Lighting Equipment (Symbolic Displays, Incorporated, P/N7146, Anticollision Strobe Lights.) Final report on Project 18. (U)

Report no. NATC-WST-19R-73 January 26, 1973 6p. AD 907 207L (USGO)

624. Neal, J. et al

Study of the Integration and Evaluation of an Aeronautical Satellite System in Oceanic Air Traffic Control Centre.

Plessey Co., Ltd. Engineering Dept. Report 84/71/37 vol. 1 and 84/71/42 vol. 2 November 23, 1971 N77-25137 and N77-25138

An analysis is presented of a system using aeronautical satellites as a means of providing an air traffic control facility in the North Atlantic (Aerosat system). The main

concern is achievement of a reduction of separation standards. A method of allocating flights to lanes and time slots, as well as showing how flight paths can be merged and crosse, is defined.

625. Near Collision Due to Poor Traffic Control Procedures -- NTSB.

Aviation Daily October 7, 1976 p. 205

A near midair collision between a Hughes Airwest DC-9 and a Northwest DC-10 on April 1, 1976 was caused by "inadequacy of the local air traffic control procedures," according to the NTSB. Also contributing to the near collision was the Spokane tower controller's failure to recognize and resolve the impending conflict and the Airwest pilot's failure to follow company approach procedures and FAA recommendations for position reporting.

626. Near Midair Collisions Between Military and Civilian Aircraft.

U.S. Congress. House. Committee on Government Operations, Twenty-Second Report. House Report No. 94-1181. May 20, 1976 22p.

The report recommends that the FAA and the Navy establish Fleet Area Control and Surveillance Facilities (FACSFAC) wherever there is a volume of military aircraft using offshore warning areas for training exercises. This creates "a serious potential for midair collisions with civilian aircraft operating, in FAA-controller airspace". According to the NTSB only 9% of the actual midair collisions which occurred between 1955 and 1975 involved military aircraft. However, 125 of the 269 near midair collisions reported to the FAA in 1975 involved military aircraft, and 44% of those same incidents involved a civilian and a military aircraft.

627. A Near Miss.

Flight Safety Focus No. 1, p. 4-12, January 1977

Very complete review of NTSB report of CAS incident on April 1, 1976 near Spokane, Wash., between Hughes Airwest DC-9 and the Northwest Airlines DC-10.

628. Near Miss At Spokane Result of Faulty Radar Procedures.

Aviation Daily July 22, 1976 p. 118

The near midair collision of Hughes Airwest and Northwest Airlines over Spokane, Airport April 1, 1976, was caused by faulty and incomplete radar procedure information, according to NTSB.

AD-A065 368 NATIONAL AVIATION FACILITIES EXPERIMENTAL CENTER ATL--ETC F/G 1/2
COLLISION AVOIDANCE: AN ANNOTATED BIBLIOGRAPHY MAY 1972 - NOVEM--ETC(U)
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The safety board concluded there was no ready reference to alert the crewmembers of either airplane that they were transitioning from a radar to a non-radar environment and that approach procedures would have to be altered accordingly.

629. Nelson, R.G. and Nuckols, J.H.

A Hardware Implementation of the ATCRBS Reply Processor Used in DABS.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72-WAI-261 FAA Report RD77-92 (ATC-78) September 1977 58p.

This report gives a detailed functional description of this processor as implemented by Lincoln Laboratory. With minor modifications it could serve as the ATCRBS Reply Processor for a Beacon Collision Avoidance System.

630. The Netherlands Proposes the Largo.

Aviation Intern. (France) no. 670, p. 57, 1975

Air Force Systems Command, Foreign Technology Div. FTD-ID(RS)I-2496-75 January 5, 1976 6p. Translation from French. AD-A020 462 N76-27209

The Netherlands proposes a new system of controlling civil air traffic, known temporarily as 'Largo'. According to the terms used during a press conference the 'Largo' is a modular mini-system which relies in particular on a computer with duplicate programs to avoid conflicts of traffic when proposing the most adequate solutions to the controller, when computing the ideal time for each take-off, during the exchange of radar information with other centers, etc. The system is based on using LAR-II radar which usefully sweeps the air space between 1000 m and 370 km up to an altitude of 120,000 feet and which has an antenna rotation rate which can be set between 6 and 12 rpm. Considering its fundamental characteristics, the same radar thus makes it possible to control distant zones at the same time as it controls the terminal of an airport.

631. Neuman, D.D.

SEEK BUS -- A Time Division Multiple Access System.

AIAA Digital Avionics System Conference, Boston, Mass., April 2-4, 1975. Paper 75-564 5p.

The system SEEK BUS is being developed for the U.S. Air Force as an aid in improving the effectiveness of its air operations. In aircraft, SEEK BUS provides the data required for operations, related to collision avoidance, station-keeping, rendezvous, air-to-air coordination, identification, navigation, and instru-

ment landing. The network architecture is considered along with questions of system feasibility, aircraft position determination, system performance, system capacity, and questions of signal structure.

632. Neumann, Horst A.

Data Processing for ATC.

In: AGARD-A Survey of Modern Air Traffic Control. AGARD-AG-209 Vol. 1 p. 159-172 (1975) N75-32047

There are two main objectives of data processing for air traffic control: first, support of tactical control by the provision of a sophisticated display of the air traffic situation and by the application of procedures of real-time conflict detection and solution; second, avoidance of air traffic congestion as well as reduction and balancing of the load of both the planning and by hierachical structuring of planning and control functions.

633. New Capabilities Developed for ARTS-3.

Aviation Week & Space Technology vol. 100, no. 3, p. 55, 57-58, January 21, 1974

Automatic conflict detection software, developed by Sperry Rand's Univac division under FAA sponsorship, for ARTS-3 automated radar terminal system conducts its search on the assumption that each aircraft can be anywhere in the double-scimatar shaped area during the next 60 sec. of flight, based on a 3 deg./sec. rate of turn and 250-kt. speed. The "assured margin" or separation at the time the controller is alerted and the "look-ahead" warning time strongly influence the burden that the new feature will impose on existing ARTS-3 computers. Present thinking is that the controller would be alerted when two aircraft were within 3 naut. mi. of conflict.

634. Nixon, Stuart

The 20-Year Wait on Airborne Collision Avoidance.

Air Line Pilot vol. 44, no. 9, p. 26-28, September 1975

Compares the various systems being considered by FAA. Aside from its sophistication, the selling point of the Litchford concept is its ability to work with existing avionics. The first aircraft to install it is automatically protected from all other transponder-equipped traffic. By contrast, EROS,

VECAS and AVOID are "cooperative" systems, requiring installation of new hardware in all participating aircraft.

635. The Non-Synchronous Techniques -- Collision Avoidance.

Aircraft Engineering vol. 44, no. 3, p. 16-19, March 1972

This article describes the RCA SECANT system.

636. North American Rockwell Corporation. Autonetics Avionics and Sensors Division.

Fourth Generation Air Traffic Control Study.

Prepared for the Transportation Systems Center under Contract DOT-TSC-304-1. June 1972 4 vols. PB 212 174 -- 212 177

A study and analysis was conducted to extend the work of the Air Traffic Control Advisory Committee in defining a Fourth Generation ATC System capable of safe and economical management of CONUS and oceanic air traffic in the post 1990 time period. The analysis considered several candidate systems capable of managing air traffic over a wide variety of operational conditions. Discusses means of maintaining separation standards.

637. O'Donnell, J.J.

Statement of the President of the Air Line Pilots Association.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 76-82.

Speaks in favor of the Frank E. Moss Bill S.2264.

638. O'Donnell, John J.

Revised Statement of the President, Air Line Pilots Association, International.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress. Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO 1972. p. 191-195

Highly critical of the FAA alleging a lack of urgency in the development of workable hardware that will enable the pilot to know when a midair collision is possible and eminent.

639. O'Hare Ground Radar Not Functioning Properly At Time of Collision.

Aviation Daily vol. 205, no. 17, p. 131, January 24, 1973

Collision between a Delta Air Lines Convair 880 and a North Central Airlines DC-9 which cost 10 lives on December 20, 1972 was due to unreliable ground radar.

640. Olsen, Stephen R.

Helicopter High Intensity Anti-Collision Strobe Lights.

Military Airlift Command Report No. MAC-OT/E-16-2-77 June 1977 14p. AD-B019 855L Limited to USGO

641. $1,000 PWI Coming

AOPA Pilot vol. 16, no. 6, p. 91-92, June 1973

Rock Avionic Systems expects to have 10 proximity warning indicators ready for installation in general aviation aircraft starting in August 1973.

642. Optical Encoding Altimeter Introduced.

Aviation Week & Space Technology vol. 100, no. 7, p. 70, February 18, 1974

Briefly discusses the Kollsman PWI which responds to infrared radiation from aircraft xenon strobe lights and is similar to the unit developed several years ago by Loral Systems and is now being manufactured by Rock Avionic Systems.

643. Orlando, V.A. and Welch, J.D.

Beacon CAS (BCAS): An Integrated Air/Ground Collision Avoidance System.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72WAI-261 FAA Report RD 76-2 (ATC-62) March 23, 1976 20p. AD-A023 035 N76-24196

The beacon collision avoidance system (BCAS) is a discrete address beacon system (DABS) based airborne collision avoidance system that exploits the features of DABS discrete addressing and integral data link. This provides for a CAS with the unique capabilities of (1) cooperative threat resolution between BCAS and conflicting aircraft through the transmission of maneuver intent (to DABS-only aircraft) and tie breaking (with other BCAS aircraft) and (2) coordination of CAS activities

with the ground ATC control function through the DABS air-ground-air data link. All beacon-equipped aircraft in the vicinity of the BCAS are detected. The ATCRBS-equipped aircraft are interrogated using a special Mode C interrogation. The DABS aircraft are detected passively through periodic squitters emitted by all DABS transponders. Squitter-detected aircraft are tracked on altitude and only those aircraft that represent a co-altitude threat are discretely interrogated to establish a range/altitude track. The use of discrete addressing eliminates synchronous garble for the BCAS in the same manner as for DABS. A general description is given of BCAS from the viewpoint of its operational features and the avionics package required to achieve this capability is described.

644. Osmun, William G.

Collision Avoidance: Comment on article by Joan Feldman.

Government Executive Vol. 4, no. 10, p. 9, October 1972

Corrects a statement.

645. Palicio, P.A. and Golden, J.F.

Conflict Resolution Maneuvers in an Intermittent Positive Control System.

Paper before the AIAA Guidance and Control Conference, Boston, Mass., August 20-22, 1975. AIAA 75-1125. 10p.

This paper compares the effectiveness of horizontal and vertical collision avoidance maneuvers in an Intermittent Positive Control system by studying the results of a Monte Carlo simulation of encounters between two aircraft. It is recommended that horizontal maneuvers be used for solving encounters between low performance aircraft. For solving encounters between high performance aircraft, and between a high performance and a low performance aircraft, vertical maneuvers are the best choice.

646. Palicio, Pedro A.

Effectiveness of Horizontal and Vertical Maneuvers In an Intermittent Positive Control System.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6800 February 1975 68p.

This report compares the effectiveness of maneuvers in an IPC system by studying the results of a Monte Carlo simulation of encounters between two uncontrolled aircraft. Results are

scatter plots showing horizontal and vertical separations at closest approach when both aircraft respond to commands and when one aircraft fails to respond to its commands. In the latter case, the one that produces the smallest minimum separation is used to evaluate performance. Recommendations are made on the most appropriate type of maneuer to solve different kinds of encounters.

647. Palicio, Pedro A.

Effectiveness of the BCAS Remitter Logic in Resolving Non-Turning Aircraft Encounters.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-7231 May 1976 50p.

This report analyzes the effectiveness of the BCAS remitter logic in resolving conflicts between non-turning aircraft. It accomplishes this objective by studing the results of a Monte Carlo simulation of aircraft encounters. Results are presented as scatter plots showing horizontal and vertical separations at the point of closest approach.

648. Palmieri, S. et al

An Air-Traffic Simulation Model for the Area Around an Airport, Directed Particularly Toward the Study of Collision.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany, October 2-5, 1973. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 2. 17p.

An air traffic simulation model of the zone of space controlled by a general airport is presented. The optimum conditions for the functioning of the central system with particular attention given to collisions and airport capacity are examined. This model makes it possible to study collisions under certain environmental conditions, facilities and traffic intensities.

649. Paradis, A.R.

L-Band Air-to-air Multipath Measurements.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA77WAI-727 FAA Report RD 77-87 (ATC-77) September 6, 1977 100p.

A series of air-to-air earth-scattered L-Band multipath measurements are described and experimental results presented. During these measurements RF pulses were transmitted between

two instrumented general aviation aircraft flying coaltitude, diverging paths over a variety of terrain and water surfaces. Multipath data was collected over grazing angles ranging from 5° to 75°. The objectives of these measurements were the: (1) Characterization of the multipath environment in which beacon based airborne collision avoidance (BCAS) equipment would operate; (2) Investigation of the merits and limitations of various degrees of antenna diversity in the rejection of multipath.

650. Park, Stephen K., Straeter, Terry A. and Hogge, John E.

An Analytic Study of Near Terminal Area Optimal Sequencing and Flow Control Techniques

In: AGARD CP-105 Air Traffic Control Systems. April 1973 18p.

Mathematical models are developed to support the optimal path generation, sequencing, and conflict resolution problems.

651. Parker, L.C.

General Aviation Air Traffic Pattern Safety Analysis.

National Aeronautics and Space Administration Paper A-24 Presented at the System Safety Society Symposium, 17 July 1973. NASA-TM-X-69455 July 1973 22p. N74-13422

A concept is described for evaluating the general aviation midair collision hazard in uncontrolled terminal airspace. Three-dimensional traffic pattern measurements were conducted at uncontrolled and controlled airports. Computer programs for data reduction, storage retrieval and statistical analysis have been developed. Initial general aviation air traffic pattern characteristics are presented. These preliminary results indicate that patterns are highly divergent from the expected standard pattern, and that pattern procedures observed can affect the ability of pilots to see and avoid each other.

652. Parsons, J.L.

Aircraft Collision Avoidance System.

In: IFALPA NEWNAV Symposium, Frankfurt am Main, West Germany, October 5-7, 1971, Report. Volume 2 p. III-2-1 to III-2-19 Frankfurt am Main, Versinigung Cockpit, 1972.

Review of the basic principles, operation, potential capabilities, and current and forthcoming tests of the RCA midair collision avoidance system involving separation control of aircraft by nonsynchronous techniques.

653. Parsons, J.L.

Collision Avoidance Devices.

Ortung und Navigation no. 1, p. 93-104 (1972) In German.

Description of a recently developed series of collision avoidance devices, and review of the results of flight tests of these devices. The SECANT system with its various instruments is discussed.

654. Parsons, J.L.

SECANT -- A Solution to the Problem of Midair Collisions.

In: AGARD CP-105 Ait Traffic Control Systems. Papers presented at the 14th Meeting of the Guidance and Control Panel of AGARD held in Edinburgh, Scotland, 26-29 June 1972. Paper 23-1 to 23-11.

The paper describes the principal characteristics of the system which uses non-synchronous techniques -- developed by RCA.

655. Parton, Clyde A.

Statement of the Vice President and General Manager of Government and Aeronautical Product Division, Honeywell, Inc., Minneapolis, Minn.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 140-145

Discusses Honeywell's activity relative to the critical problem of prevention of aircraft midair collisions. Mentions the fact that Honeywell and the Army have implemented successfully an operational pilot warning indicator, tested a modified PWI, which includes relative bearing information, and produced three flightworthy prototypes of a collision-warning system which includes the basic required characteristics needed for an effective anticollision system. These are relative altitude collision threat evaluation, and relative bearing information if desired.

656. Pau, L.F. and Nilsson, B.

Optimization of Air Routes with a View to Minimizing the Risk of Collision.

Navigation (Paris) vol. 22, p. 259-274, July 1974 IN FRENCH.

Putting in service the new airport of Copenhagen-Saltholm, Denmark, temporarily requires the utilization of two neighboring airports. For this reason, it is considered necessary to optimize the flight procedures and the air routes, in order to make the two airports independent while minimizing the risk of collision. A three-dimensional geometric model of the air space in the terminal zone is proposed, and a procedure of optimization which minimizes the number of potential conflicts and the risks of collision at these points. A formula is given to evaluate them in the case of two secant or neighboring trajectories. A74-38098

657. Pelegrin, M.J.

Automatisms In Supersonic Transport.

IFAC, IIC, and ANIPLA, Symposium on Automatic Control In Space, 5th, Genoa, Italy, June 4-8, 1973, Paper. 36p.

Discussion of the various supersonic transport automatic control systems, covering collision avoidance systems, passenger comfort equipment, clear air turbulence detection systems, microwave landing systems, stability and maneuverability control systems, propulsion control, and air conditioning. Mode specifications for automatic pilot, automatic throttle, and automatic director are also included.

658. Perie, Michael E. et al

Intermittent Positive Control: A Ground-Based Collision Avoidance System.

In: Plans and Developments for Air Traffic Systems. Papers presented at the 20th Symposium of the Guidance and Control Panel, held in Cambridge, Mass., 20-23 May 1975. AGARD Conference Proceedings No. 188 Paper 18. 17p.

Intermittent Positive Control (IPC) is a totally automated ground-based collision avoidance system. It functions by taking positive control of VFR and IFR aircraft on an "as needed" basis to avoid hazardous encounters. By also providing pilots with continuous information on the location of nearby aircraft, it results in safety in controlled, mixed, and uncontrolled airspace, among all users in both IFR and VFR flight, while maintaining the freedom of action associated with VFR flight. To receive IPC service an aircraft must carry a DABS transponder and an IPC display. The transponder, in addition to its beacon function, receives digital messages from the ground and presents them on the IPC display. The ground portion of the IPC system consists of the DABS sensor and an IPC computer.

659. The perils of Proximity

Flying vol. 94. no. 2, p. 79, February 1974

Advertisement by Rock Avionic Systems, N.Y. of APWI, an updated version of the Loral Vigilaire. The device detects strobe-light emissions -- usually before the pilot can -- by means of two wing-tip-mounted sensors.

660. Perkinson, R.E.

The Case for Time/Frequency Collision Avoidance.

ICAO Bulletin vol. 28, no. 11, p. 24-27, November 1973

Ten years of concentrated effort have gone into this CAS programme by McDonnell Douglas. They believe that the time frequency CAS is a well developed, proven, total system that can be put into operation immediately to provide additional air safety.

661. Perkinson, Robert E. and Watson, Fred D.

Airborne Collision Avoidance and Other Applications of Time/Frequency.

IEEE Proc. vol. 60, no. 5, p. 572-579, May 1972

Time/frequency technology provides a reliable aircraft collision avoidance system that can operate in either synchronous or asynchronous modes. Precision time-ordered techniques of CAS provide both range and range-rate measurements in a one-way sense to all aircraft as well as ground stations within range of transmitted microwave signals. The cooperative system utilizes exact frequency references coupled with precise synchronization: control of frequency to 1 part in 10^8 and time to less than 1 μs.

662. Perry, J.S.

CAS Choice: Letter to the Editor.

Aviation Week & Space Technology vol. 104, no. 9, p. 70, March 1, 1976

Finds fault with the selection of active B-CAS as it is not a new bright idea "The need for DABS on the grounds of ATCRBS overload has evaporated. Do we now want to add on an active B-CAS to overload ATCRBS to help justify a DABS system or are we using DABS to justify using an active B-CAS? It is somewhat a puzzle."

663. Phillips, C.O., Concannon, P.A., Brandel, D. and Meyer, E.

Flight Test Evaluation and Analysis of an Optical IR PWI System.

Transportation Systems Center Final report DOT-TSC-NASA-72-1 NASA-CR-129525 June 1972 46p. N73-12463

The test program is described and the flight test data presented. The data is analyzed and used to calibrate a model that is developed to characterize the system performance. The cumulative probability of detection versus range from a given system threshold is calculated and compared with the PWI performance specification. The comparison indicates that the Optical IR PWI system tested met the specifications for a detection likelihood of 95 percent for a 1 nmi range for an appreciable fraction of the testing time.

664. Phillips, Charles O.

Measurements of Aircraft Xenon Strobe Light Characteristics.

Transportation Systems Center FAA Report RD 76-124 (TSC-FAA-75-15) August 1976 80p. AD-A030 855

This report provides data on the characteristics of aircraft xenon strobe lights related to their potential for use as the cooperative element in Optical IR (Infrared) Airborne Proximity Warning Indicator (APWI) systems. It includes a description of pertinent characteristics, measurements of radiation geometry and power output of selected strobes, a discussion of environmental effects including lamp aging, variation in supply voltage, thermal and installation effects. Detailed measurements of spectral peak radiant intensity in addition to spectral radiant energy are presented along with measurements of rise time, duration, and fall time as a function of wave length.

665. Pilots Call for Independent Airborne Collision Avoidance System.

Aviation Daily vol. 228, no. 17, p. 134, November 23, 1976

Jack Howell of the Air Line Pilots Association told representatives of RTCA thirteen (13) items they want an air-to-air collision avoidance system to have.

666. Pilots In Wisconsin Midair Had Little Time For Avoidance.

Aviation Daily vol. 203, no. 18, p. 141, September 27, 1972

Pilots of a North Central Convair 580 and an Air Wisconsin DHC-6 which collided in midair over Lake Winnebago, Wis.,

June 29, 1972 had only a few seconds to see and avoid each other according to testimony given at a NTSB hearing into the crash which killed all 13 occupants of the two planes.

667. Plumeyer

Hardware for Time Synchronous Systems.

In: Technische Universitaet, Brunswick, West Germany. Civil Transport Aircraft Short Range All-Weather Flight. September 1976 p. 41-46 N77-32118 In GERMAN

The development of a frequency controllable quartz oscillator (synthesizer) to replace the atomic clock used in synchronous collision avoidance systems, notably of the variable frequency splitter, is described.

668. Pool, A.

The Establishment of Safe Separations Between Aircraft in Flight.

National Aerospace Lab., Amsterdam, Netherlands. Report No. NLR-MP-75041-U December 1975 12p. N77-11020

In: Managing Safety; Proceedings of the Twenty-eighth International Air Safety Seminar, Amsterdam, Netherlands, November 2-6, 1975. Arlington, Va., Flight Safety Foundation 1975. p. 197-204.

The history of the use of models and statistical data for the assessment of separation standards is reviewed. This work was mainly done by the ICAO Vertical Separation Panel, the North Atlantic Systems Planning Group and the ICAO Panel for the Review of the General Concept of Separation. After a brief description of the model and of the target level of safety, plans for future work are indicated.

669. Pool, A. and Simons, J.L.

Results of Calculations for Monitoring the Safety of the Lateral Separation in the NAT MAIN Area for the Period 1973-1977.

National Aerospace Lab. The Netherlands Report No. NLR TR-73057 August 1973

The NAT SPG II method to calculate the risk due to loss of lateral separation of aircraft has been applied to the NAT main area data of 1971 and 1972. A calculation for the safety in the period 1973-1977 is made on the basis of occupancy forecasts. The influence of opposite-direction traffic as well as composite separation is investigated. Special attention is paid to the so called blunder type errors, which are handled by an adapted risk model.

670. Potts, Cyrus E. and Roeber, John F.

Time/Frequency and Transportation.

IEEE Proc. vol. 60, no. 5. p. 597--589, May 1972

Current and future problems are presented for the land, sea, and air transportation environments that are, or can be solved using time/frequency technology. Problem areas in transportation encompass vehicle surveillance and location, traffic management, collision avoidance, command and control, communications, navigation, and search and rescue. The authors conclude that time/frequency technology can solve some of today's problems in transportation, and it offers economic integrated-system solutions to future problems with concurrent frequency spectrum conservation. The interrelationships of navigation, communication, and time/frequency systems should encourage coordinated efforts of disciplines in the design of multipurpose systems as opposed to a proliferation of new single-use facilities.

671. Pozesky, M.T.

The Discrete Address Beacon System -- Development, Transition, and Introduction.

In: Upgrading the ATC System: Proceedings of the Annual Meeting, Washington, D.C., November 28, 29, 1973. Washington, D.C., Radio Technical Commission for Aeronautics, 1973. 12p.

The DABS is being developed both to improve the accuracy and reliability of the ATC surveillance system and to provide a digital air-ground data link for intermittent positive control and other ATC functions. Aspects of the motivation for DABS are discussed together with the DABS program, questions of the transition from the ATC radar beacon system to DABS, and air carrier considerations.

672. Pozesky, Martin T.

BCAS -- An Overview.

AEEC Letter N76-106/AXX-00 October 11, 1976 7p.

Paper before the Avionics Engineering Seminar on "Beacon-Based Separation Assurance Systems" held at Munich, Germany, September 3, 1976. Presents a brief overview of recent events leading to the emergence of the BCAS concept, discusses some of the implications of this approach, and presents a brief review of near-term plans for the system development.

673. Preliminary Assessment of the Safe Separation Between the Center Lines of Parallel Routes from Model Studies.

ICAO Review of the General Concept of Separation (RGCSP Panel) Second Meeting WP/27 October 1973

674. Preventing Midairs in Terminal Areas.

Aerospace Safety vol. 28, no. 7, p. 4-6, July 1972

Most of the article is devoted to air traffic control, primarily through the use of radar. Emphasises the need for pilots to use the see and be seen method and lists those things that will help the pilot avoid being responsible for collisions.

675. Prewitt, D.E.

Federal Common Law of Aviation and the Erie Doctrine.

Journal of Air Law and Commerce Vol. 40, p. 653-660, Autumn 1974.

Over the past decade a controversy has developed over the question as to whether there should be a federal common law pertaining to civil aviation litigation. This controversy has evolved as a result of the application of the Erie doctrine by federal courts sitting in aviation diversity cases and related shopping by skillful litigation counsel. Some very recent federal decisions have generated further controversy in this area of law, particularly a recent decision by the Seventh Circuit Court of Appeals in the case of Kohr v. Allegheny Airlines, Inc. That decision holds that there is a federal law of contribution and indemnity based on comparative negligence governing midair collisions of aircraft within the United States.

676. Probable Cause Assigned for 707/Cessna In-Flight Collision.

AOPA Pilot vol. 15, no. 9, p. 108-109, September 1972

Collision occurred January 9, 1971 over Edison, N.J. Holding that the collision hazard between IFR and VFR traffic operating in controlled airspace was made critical in this instance by the marginal visibility, NTSB declared that "the weakness of the see-and-avoid concept of collision avoidance has been illustrated once again by this accident."

677. Proctor, J.D.

Vertical and Lateral Separation.

Journal of Navigation vol. 28, no. 3. p. 372, July 1975

Briefly illustrates a system which would minimize the risk of collision due to air traffic control failure.

678. Quinn, David C.

Collision Avoidance in Court.

Flight vol. 64, no 18, p. 57, July 1975

Short reviews of recent litigation relative to collisions.

679. Radar Myth-Conceptions.

FAA General Aviation News vol. 15, no. 9, p. 8,9, January 1977.

Aerospace Safety vol. 33, no. 4, p. 20, 22, April 1977

Radar advisories are an infinitely useful aid in helping the VFR pilot maintain his own separation, but they are not to be regarded as evidence that a controller has taken over responsibility for such separations.

680. Raditz, Michael, et al

Flight Test Evaluation of SECANT VECAS Collision Avoidance System.

Naval Air Development Center Report no. NADC-74207-60 November 1974 261p. AD-A-002 281 N75-19220

SECANT is a candidate for a national standard collision avoidance system. The VECAS (Vertical Escape Collision Avoidance System) version was evaluated for ability to communicate accurately and with sufficient distance to provide timely and correct advisories and maneuver commands in simulated high traffic density.

681. Ramsey, John L.

Effectiveness Limitations of Midair Collision Avoidance Strategies.

Institute of Navigation, Annual Meeting, 29th, St. Louis, Mo., June 19-21, 1973, Paper. 25p.

Navigation vol. 20, no. 4, p. 357--369, Winter 1973-1974

The purpose of this paper is to provide data to help resolve the uncertainty about what specific technique or classes of techniques ought to be used to prevent midair collisions. First, a statistical analysis of recent midair collisions in the United States and of the pertinent factors surrounding these accidents is given. Next, three classes of prevention techniques are described briefly, highlighting their important

strengths and weaknesses. These classes are: regulatory changes including structured or regulated airspace; introduction of an autonomous, airborne CAS; and projected improvements to the ATC system. The statistical data from the first part of the paper are applied to these classes to estimate the fraction of fatalities and accidents that might be prevented. From this analysis, one can draw conclusions that suggest specific steps and ordering of steps that should and should not be undertaken in a sensible, unified program to reduce the incidence of midair collisions.

682. Ranger, Frederick and Goodwin, John

Preliminary Test and Evaluation of the Intermittent Positive Control/ Air Traffic Control System Interface with the NAS Enroute System.

FAA, NAFEC Project No. 122-111-010 Report RD 74-163 (NA 74-20) January 1975 22p.

This report describes tests in a dynamic interactive controller environment simulating a low-altitude enroute airspace using digital beacon target data. Tests were designed for evaluation of the IPC-Controller display interface with respect to the timeliness and adequacy of the IPC alert and command functions. Data analysis indicates that, to bring the system to a satisfactory level of effectiveness with respect to timeliness and adequacy of the alert and command functions, improvements in the algorithm logic are necessary.

683. Ranger, Frederick W.

Test and Evaluation of the Conflict Alert Function (High Altitude) with the NAS Enroute A3d2,1 System.

FAA, NAFEC Project No. 122-112-010 Report RD75-117 (NA 75-27) August 1975 24p. AD-A014 103 N76-13037

Tests were conducted at NAFEC in a beacon only high-altitude environment with simulated digital target data. Tests were designed to evaluate the performance of the conflict alert function with respect to detection capability and adequacy of warning provided.

684. Ratcliffe, S.

Collision Avoidance and the Future of Air Traffic Control.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany, October 2-5,1973. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 2. 16p.

Journal of Navigation, vol. 26, no. 4, p. 423-230, October 1973.

This study aims to answer questions about the optimum division of responsibility between the aircrew and ground ATC, about the way in which the ATC tasks are shared between a number of controllers and ATC computers, and about the fundamental principles on which traffic flow is organized.

685. Ratcliffe, S.

Manoeuvre in Response to Collision Warning from Airborne Devices.

Journal of Navigation vol. 25, no. 4, p. 460--466, October 1972

A comparison of the ATA time-frequency system and the RCA SECANT system. The paper attempts to discuss the geometry of the escape maneuvres associated with the use of one or other of these devices; and discusses the problems facing two conventional aircraft in an encounter at an appreciable altitude.

686. Ratner, R.S. et al

The Air Traffic Controller's Contribution to ATC System Capacity in Manual and Automated Environments.

Stanford Research Institute Contract DOT-FA70WA-2142 FAA Report RD72-63 June 1972 3 vols.

Findings are presented concerning operational separation minima and their bearing on capacity, controller perceptions of system adequacy and reliability, intersector controller negotiations for coordination, and relative significance for automation of the several parts of ATC decision-making processes. The impact of these findings for effective automation is discussed. Functional automation applications with high and with low potentials for improving capacity are indicated.

687. RCA Drops Anti-collision System Work.

Electronic News vol. 20, p. 1+, December 22, 1975

688. Read, Richard E.

Midair Collision Prevention on VFR Low Altitude Training Routes.

Air War College Research Report No. 181 April 1977 47p.
AD-B018 182L(USGO)

689. Reed, J.H.

Systems for Collision Avoidance.

Journal of Air Traffic Control vol. 15, p. 5-7, January-February 1973

A Compilation of Presentations Made at the Air Traffic Control Association 17th Annual Meeting and Technical Program, 9-11 October 1972, Hotel Ambassador, Chicago, Illinois p. 30-32

Evaluation of midair collision accident data and near collision data over the past several years indicates that there is no single remedial solution to the midair collision hazard. Assessments indicated that 49% of the accidents could have been avoided if all aircraft had been radio equipped and adhered to improved procedures requiring mandatory position calls in the vicinty of uncontrolled airport areas. It was also indicated that 24% of the accidents could have been avoided if there had been published standard traffic patterns at all airports.

690. Reed, John H.

Statement of the Chairman, National Transportation Safety Board, Washington, D.C.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation Collision Avoidance and Pilot Warning Indicator System. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972 Washington, D.C. GPO, 1972. p. 195-204.

The conclusion NTSB reached, based upon the actual accident experience as well as the threat identified by near midair collision data, is simply that there is no single, remedial approach, including CAS equipment, that holds the potential for eliminating the midair collision hazard. Collision avoidance equipment, such as the McDonnell Douglas EROS or Micro CAS; the Honeywell YG-1054; the RCA SECANT; the Texas Instrument's weather IDAS simply, by itself, will not solve the problem today. However, they recommend that the testing of these systems be continued and expedited.

691. Reed, K.

Midair.

Approach vol. 20, no. 6, p. 16-17, December 1974

A personal narrative of a midair between a Skyhawk and an A-7 just prior to descent for landing -- hours of boredom punctuated with moments of stark terror.

692. Reed, William E.

Discrete Address Beacon System (A Bibliography with Abstracts Report for 1964 — January 1976).

National Technical Information Service NTIS/PS-76/0039/8GA January 1976 82p.

This bibliography contains 77 abstracts.

693. Reed, William E.

Discrete Address Beacon System (A Bibliography with Abstracts Report for 1964 — December 1976)

National Technical Information Service NTIS/PS-77/0035/4GA February 1977 103p.

This bibliography contains 98 references.

694. Research Triangle Institute.

Definition of a Terminal Area Air Traffic Model for Studies of Advanced Instrumentation and Control Techniques.

NASA-CR-111979 December 1971 281p. X72-10086

A study has been conducted to define a mathematical model of the air traffic control situation within a given terminal area. The model is intended to be used to determine the effects on the overall system of the introduction of advanced aircraft control concepts and instrumentation in both real- and fast-time simulations. In the model as defined, actual aircraft paths are generated on a computer in accordance with aircraft dynamic and performance characteristics, pilot navigational techniques and associated errors, and ground controller instructions. Techniques are developed for conflict detection, conflict resolution, and aircraft sequencing that are intended to simulate the techniques presently used by ground controllers. (Author)

695. Research Triangle Institute

Development of Simulation Techniques Suitable for the Analysis of Air Traffic Control Situations and Instrumentation.

Report no. RTI-43U-718 NASA-CR-112195 December 1972 417p. N73-14699

A terminal area simulation is described which permits analysis and synthesis of current and advanced air traffic management system configurations including ground and airborne instrumentation and new and modified aircraft characteristics. Airborne elements include traffic samples with individual aircraft performance and operating characteristics and aircraft navigation equipment. The simulation also contains algorithms for conflict detection, conflict resolution, sequencing and pilot-controller data links.

696. Review of the General Concept of Separation (RGCSP) Panel, Second Meeting Report.

ICAO RGCSP Second Meeting WP/39 Montreal, Canada October 1973 81p.

This report contains the history of the meeting and a report on the action taken on the agenda. Within the report on the actions, summaries of the results of several of the working papers are given with appropriate recommendations.

697. Robeck, P.H. and Welch, J.D.

Provisional Message Formats and Protocols for the DABS IPC/PWI Display.

Massachusetts Institute of Technology, Lincoln Laboratory Contract DOT-FA72WAI-261, Report FAA-RD-74-83 May 24, 1974 26p. AD-780 381 N75-12924

This document specifies provisional formats for the data link portion of the "signals-in-space" which are part of the DABS interrogations and replies. Also included is a discussion of the characteristics that these signals assume while transmitted from the transponder proper to the instrument which delivers the messages to the pilot. Specifically, formats, algorithms, and protocols are assigned to serve the IPC, PWI, and ATC (numerical indicator) functions. The protocol and algorithm for the pilot acknowledgment link is also included in this paper.

698. Robertson, J.

Honeywell-McDonnell CAS Dropped; Beacon Bids Due.

Electronic News vol. 21, p. 2, February 23, 1976

699. Rock, George C.

Statement of the Product Line Manager, Aircraft Systems, Loral Electronics Systems, Bronx, N.Y.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 149-159.

Gave a simple slide presentation and submitted a paper, "A Low-Cost Solution to the Problem of General Aviation Midair Collisions." He urges the FAA to immediately publicize a CAS program timetable; immediately publicize a PWI program timetable; amend FAR 91-33 to require the installation of red or

white Xenon strobe lights on all aircraft for day and night operations; acknowledge the acceptability of optical PWI's.

700. Rock Aircraft PWI Now Available.

Airport Services Management vol. 15, no. 5, p. 51, May 1974

Claimed to be the first aircraft proximity warning system to indicate the approximate position of an intruder aircraft on a potential collision course, Rock Avionic Systems' APWI (Aircraft Proximity Warning Indicator) is designed for VFR flights, where most midairs and potential midairs occur. The Rock APWL, detects the infrared emissions from standard wing, tail or fuselage mounted high intensity strobe lights on other aircraft within a 20° wedge-shaped potential collision band that becomes over 3000 feet high at the 1 1/2-mile range of the equipped aircraft. The bearings of intruder aircraft are shown by flashing sectors of a clock-like panel-mounted indicator. Wing-tip mounted sensors cover the danger area extending in a 120° arc on each side of the nose. An optional tail mounted sensor permits 360° coverage.

701. A Rocky Mountain Airways DHC-6 Twin Otter and a Beech Bonanza Collided June 28, 1974.

Business and Commercial Aviation vol. 35, no. 2, p. 20, August 1974

This collision was the second general aviation midair in seven days at Denver's Stapleton International Airport.

702. Ross, Dan. C.

Statement of the president of Ross Telecommunications Engineering Corp. and of CATV General Corp., Washington, D.C.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO 1972. p. 239-245.

He suggested that it would be unwise to pass S.2264 in its present form, and that it would be better to expedite ground-derived collision avoidance system implementation via improvement and extension of the ATC system, with particular emphasis on position data acquisition and on the integration of major segments of general aviation into the system at the earliest possible instant.

703. Rossiter, S., Windle, J., Strack, R., and Mullen, W.

Simulation Study of Intermittent Positive Control in a Terminal Area Air Traffic Control Environment.

FAA, NAFEC Project No. 034-242-010 Report RD 76-193 (NA 76-32)
January 1977 90p. AD-A034 902 N77-21070

A dynamic simulation was conducted to provide an initial and limited investigation into the operational and procedural problems that may exist when IPC is present within the terminal area ATC system. The test environment simulated a single DABS sensor site and used the IPC algorithm provided by the Mitre corporation. The results indicated that the algorithm tested adversely interacted with the present ATC system in a number of operational areas. Rather than remaining passive until required, IPC generated controller alerts and, at times, commands when controllers were following normal procedures and aircraft pairs were well outside ATC separation standards.

704. Rossiter, Sidney, Strack, Robert and Windle, James.

IPC/ACAS Comparative Evaluation.

FAA, NAFEC Project No. 034-242-010 Letter Report No. NA-76-9-LR, May 1976 41p.; also appendix A to FAA Report RD 76-193 (January 1977)

At the stage of development at which each system was tested, both systems interacted unacceptably with the ATC system in that they interfered with ATC normal operations, particularly in the area where aircraft were maneuvering to the final approach area.

705. Rossiter, Sidney B., Windle, James R. and Strack, Robert C.

IPC/GAT-IIA Pilot Reaction Test Bed Validation.

FAA, NAFEC Project No. 034-242-010 Letter Report NA-76-54-LR
October 22, 1976 21P.

The purpose of the tests for this report was to establish a flight simulation test bed that could be used to evaluate pilot reaction to IPC messages and to provide an alternative to live flight testing to the investigation of IPC algorithm logic changes.

706. Rowland, George E. and Silver, Carl A.

Aircraft Exterior Lighting and Marking.

Rowland & Company, Inc. Contract FA69-NA-357 FAA Report RD-72-24, (NA 72-29) May 1972 126p. AD-741 531 N72-22025

This study investigates the contemporary state of human factors knowledge concerning aircraft exterior lighting and marking. Efforts to increase conspicuity or impart information through resort to exterior marking or painting are now and, in the

absence of an unforeseen technological breakthrough, will probably continue to be essentially useless. An attempt to define a standardized exterior lighting system failed because sufficient hard data does not exist to compare system components. A research program is outlined for a very advanced, very large-scale exterior lighting research program for the FAA to conduct at NAFEC.

707. Rucker, R.A.

Automated IFR Traffic Control: Project Overview and Objectives.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM 75-10 (MTR-7073) November 1975 73p.

A digital computer simulation of the automated control of IFR traffic through a realistic replica of an en route arrival sector is described, along with the current plant for improving that model. The simulation is currently capable of automatically planning conflict-free clearances using altitude restrictions and assignments, updating that plan based on flight progress, and issuing the planned clearances at the proper time to assure that mimimum separation standards are not violated.

708. Rucker, R.A.

Aviation Collision Risk in the U.S. vs. Airway Lateral Separation Standards — A Historical Perspective.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-7030 September 1975 13p.

The historical record for civil aviation collisions involving at least one IFR and/or air carrier flight in the U.S. is examined and put into perspective with other types of aviation accidents and fatality losses. It is shown that there is virtually no evidence to suggest that the present U.S. lateral separation standard for airways has been a contributing factor in any collision involving at least one IFR aircraft. This paper was presented at the Third Meeting ICAO RGCSP in Montreal, 18 August-5 September 1975.

709. Rucker, R.A. and Ditmore, M.A.

Briefing Charts on the Increased Utilization and/or Expansion of the Existing ATC System to Reduce Midair Collision Risks.

Mitre Corporation Contract DOT-FA70WA-2448 Working Paper WP-11347 December 1975 56p.

Figures and tables are provided which summarize what can be done to reduce midair collision risks in the context of the existing

planned ATC system. Topics addressed are: Overview of the ATC system, an Analysis of Past Midair Collisions and Near-Midair Collisions from the Viewpoint of Today's Surveillance-Based ATC System, Reducing Midair Collision Risks with Surveillance-Based ATC Services, and Midair Collision Risks in the VFR Traffic Patterns of Controlled and Uncontrolled Airports.

710. Rucker, R.A. and Ditmore, M.A.

Briefing Charts on U.S. Civil Aviation Midair Collisions, Historical Statistics and Future Exposures.

Mitre Corporation Contract DOT-FA70WA-2448 Working Paper WP-11346 December 1975 51p.

Figures and tables are provided which summarize the historical statistics and future exposures of civil aviation to midair collision risks in the U.S. Topics addressed are: The Historical Perspective, Forecasting Possible Future Trends, the U.S. Fleet to be Protected, and Estimating the Benefits of Reducing Civil Aviation Collision Risks.

711. Rucker, R.A. and Simpson, T.R.

Civil Aviation Midair Collisions Analysis: 1972 Added to 1964-71 Results.

Mitre Corporation Contract FA70WA-2448 FAA Report EM 73-8, Addendum 1 (MTR-6334, Supplement 1) December 1974 85p. AD-A005 897 N75-29064

This study updates the cumulative results of the previous 1964-71 study to include the 25/47 collisions/fatalities which occurred during 1972. Of these, two collisions involved air carrier aircraft and accounted for 23 fatalities. The remaining 23/24 collisions/fatalities occurred between general aviation aircraft, and did not involve public air transportation.

712. Rucker, R.A. and Simpson, T.R.

TCA/ERS Effectiveness Study.

Mitre Corporation Contract FA70WA-2448 FAA Report EM-74-15 (MTR-6766) September 1974 121p. AD-A001 236/9 N75-18210

The study evaluates the relative importance of insuring that each controller involved with an ATC-served aircraft has reliable position and altitude data on both it and all nearby aircraft, regardless of whether he is serving them or not. It concludes that the Terminal Control Areas approach should be

relatively more effective than the Expanded Radar Service approach in preventing midair collisions. The TCA Approach should be most efficient in its use of controllers at automated (ARTS III) facilities for a given level of VFR participation if beacon transponders with automatic altitude reporting capability are required. It also concludes that the airport terminal areas now served by ARTS III facilities represent most of the historic midair collision risks to air carrier operations and passengers.

713. Ryan, Leonard C. et al

To See or Not To See: Visual Acuity of Pilots Involved in Midair Collisions.

FAA, Office of Aviation Medicine Report No. AM 75-5 September 1975 4p. AD-A016 277 N76-14778

The Medical records of airmen involved in midair collisions from 1970 through 1973 were reviewed and compared with two other groups of pilots: (1) pilots involved in other types of accidents and (2) pilots without any accident records. There is nothing in the results to indicate that the pilots with visual corrections are a greater risk.

714. Safety Board Reprises Recommendations.

Aviation Week & Space Technology vol. 105, no. 14, p. 63, October 4, 1976

Safety board lists recommendations concerning midair collisions which seem particularly relevant and worthy of restatement. It is the board's contention that the midair collision hazard is one of the most urgent and serious problems confronting civil aviation.

715. Safety Board Rules on Twin Otter, Cessna Collision.

Aviation Week & Space Technology Vol. 103, no. 15, p. 29, October 13, 1975

Midair collision of a Golden West Airlines de Haviland Twin Otter and a privately owned Cessna 150, January 9, 1975, near Whittier, Calif., resulted from the failure of either crew to see and avoid the other aircraft.

716. Safety Board Studies Midair Collision.

Aviation Week & Space Technology vol. 103, no. 11, p.75-77, September 15, 1975; no. 12, p.57, 59 September 22, 1975

Report of NTSB investigation into the midair collision of an Air Force Convair VT-29D and a Cessna 150H near Newport News, Va., January 9, 1975, killing a total of nine persons. The probable cause was the human limitation inherent in the see-and-avoid concept, which can be critical in a terminal area with the combination of controlled and uncontrolled traffic. A possible contributing factor was the reduced nighttime conspicuity of the Cessna against a background of city lights.

717. Sakson, P., Grossman, B. and Breda, J.

Position Location Analysis.

Hazeltine Corp. Report 6174 RADC-TR-73-293 September 1973 123p. AD-773 849 N74-20234

The program provided for the development of a real time data processing and display system for the Air Force's Low Cost Traffic Control (LCTC) experiment. The LCTC experiment will test the applicability of low-power, spread spectrum aircraft transmissions to provide the basis for a low-cost, real time, precision, aircraft surveillance and collision avoidance system. The real time data processing and display system developed makes use of a PDP11 minicomputer and a CRT display. These equipments have been programmed to accept input data from two aircraft: the input data takes the form of a set of four binary coded decimal numbers read from four time interval counters, plus standard range time (from a digital clock). Typically, a new field of numbers arrives several times a second. The PDP11 processes this input data in real time and generates a plan position display of the aircraft tracks and their projected positions. The display also presents tabular information such as aircraft heading, velocity and altitude, along with time and collision information.

718. Sample, Steven B.

Statement of the Deputy Director for Programs, Illinois Board of Higher Education, Chicago, Ill., with attachment, "A Low-Cost Directional Pilot Warning Instrument".

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing. 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 159-167.

He, along with two colleagues, Thomas Duncan and Paul Scheuer, have developed a low-cost directional pilot warning instrument. He lists seven criteria that are necessary for the instrument.

719. Sarris, Alexander H. and Athans, Michael

An Algorithm for Terminal Air Traffic Control.

Massachusetts Institute of Technology, Dept. of Electrical Engineering
ESL-P-466 NASA-CR-128398 December 1971 40p. N72-32639

An area-navigation method for automatic control of aircraft arriving in a random fashion from the en-route centers to the near terminal area is proposed. Control is exercised by a ground computer that sequences and schedules the aircraft. Altitude segregation is used to separate aircraft in velocity classes. Merging of all aircraft occurs near the outer marker. The merging region is designed so that no near misses will occur if the aircraft follow the assigned trajectories.

720. Schneider, Charles E.

ATC Hazards Feared Overlooked.

Aviation Week and Space Technology vol. 96, no. 21, p. 78-79, May 22, 1972

Near-miss reports drop sharply following ending of immunity; information lack raises concern danger situations overlooked. Of the total 109 near-midair collisions reported to the FAA during the first three months of 1972, five were attributable to systems errors. Of the total seven midair collisions in 1972 first three months, all involved general aviation aircraft in VFR conditions. System errors were not listed as causal factors. During 1971, system errors resulted in 44 near-misses.

721. Schneider, Charles E.

Near-Midair Inquiry Studies ATC Briefing.

Aviation Week & Space Technology vol. 103, no. 23, p. 28, December 8, 1975

Alert relief controller at Cleveland Center probably saved a midair between TWA Lockheed L-1011 and American Airlines McDonnell Douglas DC-10 near Detroit, November 26, 1975.

722. Schoenberger, O.H.

Rendezvous Capability for U.S. Army Collision Warning System.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany, October 2-5, 1973. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 2. 16p.

Questions regarding the midair collision problem are examined, taking into account commercial operations, military operations, and non-CAS preventable collision. Basic collision prevention methods make use of proximity warning, collision warning, and collision avoidance. The background of equipment development is explored, giving attention to device compatibility considerations, questions of operational employment, the feasibility of an azimuth capability, the performance parameters, a theoretical analysis of the collision warning device, and aspects of test and evaluation. The requirements for rendezvous capability are discussed along with the potential of a collision warning device for rendezvous operations.

723. Schrader, James H. and Couch, Richard H.

Apparatus for Aiding a Pilot in Avoiding a Midair Collision Between Aircraft. Patent.

NASA-Case-LAR-10717-1 US Patent 3,750,168 July 31, 1973 13p. N73-30641

A protected aircraft carries a transmitter, a transponder, a receiver, and a data porcessor; and an intruding cooperating aircraft carries a transponder. The transmitter of the protected aircraft continuously transmits a signal to the transponders of all intruding aircraft. The transponder of each of the intruding aircraft adds the altitude of the intruding aircraft to the signal and transmits it to the protected aircraft. The receiver selects only the signal from the most hazardous intruding aircraft and applies it to the data processor. From this selected signal the data processor determines the closing velocity between the protected and intruding aircraft, the range between the two aircraft, their altitude difference and the time to a possible collision.

724. Schuchman, L.

An Active Beacon-Based Collision Avoidance System Concept (BCAS).

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM-75-7, Addendum 1, (MTR-7036) October 1975 37p. AD-A017 102 N76-15120

The concept of an active Beacon Collision Avoidance System (BCAS) is described in this paper. The design constraints of this air-to-air collision avoidance system are given, together with the system design which enables BCAS to minimize the critical problem of garble. Results from a dynamic aircraft traffic model simulation are presented and finally the possible extensions of BCAS to high density airspace and to a DABS/IPC environment are discussed.

725. Schuchman, L.

ASTRO-DABS Updated -- 1974.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR 6770 October 1974 53p.

ASTRO-DABS has conceptually evolved as an ATC Satellite-Relayed Surveillance, Navigation and Data Link Concept. In this paper the author extends the ASTRO-DABS concept to include its own surveillance backup, to reduce the threat of jamming and to reduce user avoinics costs. The possibility of using the surveillance "backup" as the only source of surveillance information for ASTRO-DABS is also discussed. In addition, the concept has been extended to include an air-to-air CAS mode.

726. Schuchman, L. and Orr, R.

The Single-Site Collision Avoidance System (SS-CAS).

Stanford Telecommunications, Inc. DOT Contract F04701-75-C-0239 FAA Report EM 77-8 September 16, 1977 149p.

SS-CAS is a unique beacon collision avoidance system which works in conjunction with the current and next generation air traffic control surveillance systems (ATCRBS and DABS). In its passive mode, SS-CAS provides three dimensional position of both user and target aircraft using beacon replies from only one geound-based DABS or ATCRBS interrogator. Full collision avoidance service is provided in both the all-ATCRBS environment of today, the all-DABS environment of tomorrow, and the intervening transition period. The ground and airborne equipments required are add-ons to the ground beacon and the airborne DABS units. A two-way data link separate from, but compatible in format with, the DABS data link provides the SS-CAS-equipped aircraft with important site data. A tracker capable of reading reliable tracks through ATCRBS synchronous garble is employed. DABS replies arrive garble-free at the SS-CAS aircraft and are simple to track. An active mode and multi-site usage capability are available for performance enhancement in identified special situations.

727. Scott, David H.

Statement of the Washington Representative, Experimental Aircraft Association.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress. Second Session, December 1, 1971 and February 20, 1972. Washington, D.C., GPO, 1972. p. 169-172

The association would like to see a PWI or CAS system developed that is an integral part of an advanced ATC system, They do not necessarily feel that the solution is just to create another black box. It would be advantageous to get away from secondary radar as the primary means of target identification.

728. Scott, P. P.

A Simulation Model of Air Traffic Allocation to the North Atlantic Track System.

Royal Aircraft Establishment Report No. RAE-TR-73180 February 1974

This report describes a study aimed at forecasting the density with which aircraft will be packed into the North Atlantic track system as traffic flow increases in future years. This density will effect the risk of midair collision, and so the forecast density influences decisions on the size of separations between flight paths to be promulgated.

729. Scott, William V.

Clock Synchronization by VORTAC.

Sierra Research Corp. Report No. TR-0813 August 1970

Synchronized time/frequency systems have impressive advantages for overall navigation and traffic control functions envisioned in the future. Coupling of synchronized atomic clocks with VORTAC ground stations to create a Precise Time and Frequency Dissemination System offers many advantages for data, station-keeping, collision avoidance, and navigation requirements.

730. Sender, F.

Atomic Frequency Based Radio Navigation Proceeding for Long Range Navigation, Especially in Connection with Satellite Navigation Systems.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany, October 2-5, 1973. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 2 21p.

Atomic frequency standards which became commercially available during the years after 1965, made it possible to obtain an improved solution for the synchronizing problem in the case of master and slave stations, which previously had to make use of cable or relay-receiver transmission. Typical properties of atomic frequency standards are considered along with wave propagation problems of different systems. Attention is also

given to certain difficulties regarding the navigation with artificial satellites, taking into account problems related to the use of satellites in relatively low orbits.

731. Senne, Ken

What Happened to IPC? They Renamed it ATARS.

Jounal of Air Traffic Control vol. 19, no. 3, p. 12-15, July - September 1977

The new name is "Automatic Traffic Avoidance and Resolution System". ATARS backs up the basic ATC control loop with an independent, automatic loop, which is designed to provide last-ditch separation assurance with minimum disturbance to the flow of air traffic under the control of the basic ATC system.

732. Separation Assurance Seminar.

AERO LINE 76-109/AERO-16 October 21, 1976 2p.

Review of the avionics engineering seminar on Beacon-based separation assurance systems, held September 3, 1976 in Munich following the Fall 1976 AEEC General Session. BCAS, DABS/IPC, ADSEL (Address Elective SSR of UK), were covered.

733. Shaffer, J.H.

Collision Avoidance: comment on article by Joan Feldman.

Government Executive Vol. 4, no. 10, p.9, October 1972

Brief comment congratulating Joan Feldman on her thorough treatment of the subject.

734. Shank, Robert J.

Decisions for the 70's.

In: AGARD CP-105 Air Traffic Control Systems. Papers presented at the 14th Meeting of the Guidance and Control Panel of AGARD held in Edinburgh, Scotland, 26-29 June 1972. Paper 3-1 to 3-15.

The important proposed changes or improvements in the areas of surveillance, navigation, communications, collision avoidance, and instrument landing are examined; and the major issues for decision are proposed.

735. Shear, W.

Avionics for BCAS.

AEEC Letter N76-106/AXX-00 October 11, 1976 4p.

Paper before the Avionics Engineering Seminar on "Beacon-Based Separation Assurance Systems", Munich, Germany, September 3, 1976. Briefly reviews the equipment needed by both Active BCAS and Passive BCAS. One of the main objections is the fact that BCAS works within a heavily used band using a signal in space designed for an entirely different purpose while prior systems have operated in a "clear" portion of the RF spectrum with a signal format carefully engineered to minimize interference from garble, multipath, and other sources.

736. Shear, Wayne

A Standard is Needed for CAS.

In: A Compilation of Presentations Made at the Air Traffic Control Association 17th Annual Meeting and Technical Program, 9-11 October 1972, Hotel Ambassador, Chicago, Illinois. p. 43

A voluntary 100% implementation of a CAS or PWI device, regardless of effectiveness and cost cannot be expected. However, an early definition of a national standard by the FAA, so that airspace users who wish to provide themselves with an added measure of safety can quickly get on with it should be expected.

737. Shear, Wayne

Statement of the program manager for collision avoidance systems, Bendix Corp.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 16-19, 21-22.

Speaks in favor of the Bendix Time/Frequency system for general aviation.

738. Sheftel, David J.

FAA Views and Plans on Separation Assurance -- DABS/IPC/BCAS.

AEEC Letter N76-106/AXX-00 October 11, 1976 2p.

Paper presented at the Avionics Engineering Seminar on "Beacon-Based Separation Assurance Systems", Munich, September 3, 1976. Covered conflict alert, IPC, BCAS, and the requirement for transponders and encoding altimeters on aircraft operating with surveillance coverage.

739. Shelton, Dewey J.

Collision Warning System (CWS).

Modern Army Selected Systems Test Evaluation and Review Report MASSTER-Test-FM-238 August 1974 155p. AD 922 933L (USGO)

740. Shepherd, Harry S., Jr.

Infrared Output US Army Anticollision Beacon High Intensity Light.

Aerospace Guidance and Metrology Center Report No. AGMC-74-00811 January 1974 35p. AD 777 594 N74-28103

A U.S. Army Anticollision Beacon was tested for infrared output in watts per steradian from 0.7 - 1.2 micrometers. Measurement of both day and night operating modes were made which included spectral output and goniometric scans in the azimuthal and elevation planes.

741. Sherlock, J.F.

An Application of Overtaking Theory to Airways Traffic.

R.R.E. Newletter & Research Review no. 13, p. 28/1 - 28/4 (1974)

This note describes a comparison of results derived from a theoretical analysis of marine overtaking, recently published in English by T. Makishima, with those obtained using an air traffic simulation program. It briefly describes the RRE air traffic simulator which has been written in ALGOL R for the 1907 computer.

742. Siddiquee, M.W.

Mathematical Aids in Air Route Network Design.

In: Conference on Decision and Control, 4th and Symposium on Adaptive Processes, 12th, San Diego, Calif., December 5-7, 1973, Proceedings. New York, IEEE, 1973, p. 651-654

Some simple mathematical models relating to various attributes of a route network are presented. These models include number and duration of potential conflicts, intersection and air route capacity, flight and route mileage, and intersection density. Using these models enables a designer to compare quantitatively the various network design alternatives. An outline of a computer program that systematically computes the various attributes is presented.

743. Siddiqee, Waheed

Computer-Aided Traffic/Airway/VOR(TAC) Network Methodologies. Part 1: Techniques of Air Route Network Design (Tasks 1-3). Part 2: Techniques of VORTAC Grid Design (Task 4).

Stanford Research Institute Contract DOT-FA71WA-2537 FAA Report RD72-118 2 vols. N73-19643 N73-19644

Volume 1, Appendix C -- Conflict Prediction Models gives simple mathematical models for predicting the expected number of conflicts and the conflict durations at an intersection.

744. Simpson, C.G.

Recent Development in Aircraft Safety, Air Traffic Control and Navigation.

In: Economics of Air Safety and Long-range Safety Research and Development: Proceedings of the Twenty-sixth Annual International Air Safety Seminar, Lisbon, Portugal, November 4-7, 1973. Arlington Va., Flight Safety Foundation, Inc., 1973 p. 48-58

A review of recent developments in FAA E&D work in aircraft safety and air traffic control, covering aircraft airworthiness crashworthiness, and the development of the Microwave Landing System for upgrading the U.S. air traffic control and navigation systems. The important ingredients of this program are a collision avoidance system, a proximity warning indicator, and a discrete address beacon system. The program is expected to serve the needs of worldwide aviation for the next thirty years.

745. Simpson, T.R., Rucker, R.A. and Murray, J.P.

Civil Aviation Midair Collisions Analysis, January 1964 -- December 1971.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report EM 73-8 (MTR-6334) May 1973 203p. AD 766 900 N73-30946

The study analyzes all midair collisions which occurred within the 48 states over the eight year period. It develops statistical, graphical, and narrative information which is used to assess the effectiveness of the ATC system in preventing midair collisions, to identify remaining problem areas amenable to systematic solutions, and to compare these findings with several proposed solutions for reducing collision risks.

746. Simpson, T.R., Smith, A.P. and Matney, J.S.

Estimation of UG3RD Safety Benefits.

Mitre Corporation Contract DOT-FA70WA-2448 FAA Report AVP 77-8
January 1977 76p. AD-A036 895

Recent accident data on midair collisions and controlled collisions with the terrain were examined to identify types of accidents that could be prevented by the UG3RD. "Preventable accident" rates were calculated and used to forecast future accidents under an extension of today's system and accidents that could be prevented by the UG3RD.

747. Simpson, William E.

Future System Concepts for Air Traffic Management.

In: Handling the Air Traffic of the Long-Term Future: 19th Technical Conference of the International Air Transport Association, Dublin, October 23-28, 1972. Montreal, Canada, IATA, 1973? WP-17 19p.

The demand levels projected for the 1990's indicate that over 50,000 aircraft may be instantaneously airborne over the United States, with distributions such that 1200 or more aircraft may be airborne in a representative major hub area. The capability to provide for increased capacity in high density areas implies that both the air traffic management system and the users of the system can safely and conveniently operate with a larger number of aircraft per volume of airspace. Safe separation requires that the traffic management system be able to detect a potentially hazardous traffic conflict and advise the affected aircraft so that sufficient time is available for the pilots to take the actions necessary to avoid collision. Surveillance and navigation accuracy requirements are therefore developed to support projected traffic flow rates and provide for safe separation distances consistent with the control concept.

748. Singleton, L.J.

SECANT -- A Solution to the Problem of Midair Collisions.

In: Air Traffic Control Association, Annual Meeting and Technical Program. 17th, Chicago Ill., October 9-11, 1972, Proceedings. Wash., D.C., The Assoc., 1973. p. 36-40

This cooperative, transponding collision-avoidance system, designed to be compatible within the entire aviation community, is capable of accommodating the dense air traffic anticipated for the 1980's and beyond. It makes available to the pilot

evasion or escape maneuvers in any direction -- vertical, horizontal or a combination. SECANT helps the pilot avoid midair collisions by transmitting probes and receiving replies with a microsecond pulse of up to 1000 pulses/per sec on 24 different frequencies. Various discriminants are used to eliminate undesired signals, and the false alarm rate is near zero.

749. Sinha, A.N.

Advanced Air Traffic Management System B: ATC Automation Analysis.

Mitre Corp. DOT Contract FA70WA-2448 Technical report MTR-6419, Series 7. January 30, 1974 65p.

Also published as: FAA, Office of Systems Engineering Management Report EM 73-10A, Series 7 February 1974 65p.

This report discusses the ATC automation requirements of the control center configurations of the Mitre study of AATMS System B -- extension of the Upgraded Third Generation ATC System. Computer sizing estimates are presented for all the control centers in the System B 1995 configuration. Cost estimates, in current dollars, for the computer systems, based on existing technology, are also presented in Part I of this report.
Part II discusses the Intermitent Positive Control (IPC) service and the static conflict counts in the 1995 L.A. hub model.

750. Sinha, A.N. and Haines, A.L.

Longitudinal Separation Standards on Final Approach for Future ATC Environments.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6979 October 1975 40p.

The purpose of this analysis is to develop a common set of predictions of the longitudinal separation standards on final approach and other technological parameters to be used in studies related to the elements of the FAA E&D program. Based on a set of four groupings of future ATC environments, separation standards are developed for both VFR and IFR weather conditions.

751. Smedley, James W.

Let's Eliminate This Hazard to Pilots and Controllers.

Flight vol. 62, no. 13, p. 24-25, 27, December 1973

Unnecessary Stage III radar service creates collision conditions for pilots and workload pressure damaging to health of controllers.

752. Smith, A.P.

An Assessment of Separation Standards Methodologies Applicable to Future Oceanic ATC Systems.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6767 February 1975 44p.

The AEROSAT program will evaluate several improved oceanic air traffic control system configurations using satellite communications and surveillance. One of the benefits expected to be realized from an improved oceanic ATC system is a reduction in oceanic separation standards with no degradation in safety and the associated reduction in the cost of oceanic air operations resulting from the following of more optimum flight paths. In order to evaluate the allowable separation standards commensurate with each of the candidate oceanic ATC systems, a methodology is needed which encompasses the various aspects of the system in an accurate manner and which is acceptable to the rulemaking authorities. The purpose of this report is to identify the types of parameters, concepts, and considerations which will impose necessary conditions on an adequate methodology and then to evaluate the currently available methodologies and models as to their adequacies and deficiencies in terms of evaluating candidate oceanic ATC systems.

753. Smith, C.L.

The Need for a Workable Collision Avoidance System -- Now.

Safe Journal vol. 7, p. 32--33, Fall 1977

The need to move ahead on achieving a workable collision avoidance system for aircraft is argued. The BEACON CAS is recommended as 'earliest possible installation milestone', and as capable of identifying an imminent collision 30 sec prior to impact. Criteria on CAS acceptance recommended by the Air Line Pilots Assoc. as 'of primary importance' are presented. Data are presented on total system errors and midair near-misses for the years 1972 through 1975.

754. Smith, Humphry Montague

International Time and Frequency Coordination.

IEEE Proc. vol. 60, no. 5, p. 479--487, May 1972

The significant advances in the development of international coordination in time determination and dissemination are briefly reviewed.

755. Smith, Kenneth M.

Statement of the Deputy Administrator, Federal Aviation Administration, Department of Transportation.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1,1971 and February 29, 1972. Washingotn, D.C., GPO, 1972. p. 205-231

He summarized, although a functional CAS system has been developed, unresolved problems remain regarding high initial cost, maintainability, and potential interference with the ATC system. The search for an implementable CAS or PWI continues. In short, there is insufficient information at this time to select a specific CAS or PWI design for national implementation.

756. Smoot, Wayne E.

Longitudinal Separation Analysis of the Central East Pacific Track System.

FAA, NAFEC, Project No. 012-605-000 Report No. EM 77-3 (NA-76-39) June 1977 106p. AD-A040 759 N77-29117

This report represents an evaluation of aircraft mach number spacing and inertial navigation systems (INS) as regards their impact on longitudinal separation and collision risk in the Central East Pacific. Results indicate that a statistically significant difference in maintaining longitudinal separation exists between those aircraft employing mach number spacing techniques and those not using the techniques, and likewise between aircraft with more sophisticated air data systems than those without. Collision risk from loss of longitudinal separation was found to be at an acceptable level, both in the old and current CEP systems.

757. Some Pilots Are Taking Off with Incorrect Transponder Settings.

Business and Commercial Aviation vol. 35, no. 3, p. 28, September 1974

"Aviation Safety Institute says that reports indicate that in some cases pilots are departing an airport with the transponder code still set to the approach frequency. If the same code is then assigned another aircraft, automated radar will pick up only the first plane appearing on the screen. This may result in the controller guiding the wrong aircraft, resulting in a potential midair collision as the incorrect target is mistakenly sent in the path of another plane. As a rule B/CA pilots reset to 1200 after landing as a part of the post flight checklist to avoid this problem."

758. Sorensen, J.A. et al

Aircraft Guidance for Automatic Collision Avoidance.

International Federation of Automatic Control, Symposium on Automatic Control in Space, 6th, Tsahkadzor, Armenian SSR, August 26-31, 1974, Paper. 16p.

This paper is concerned with the development of the guidance system requirements for automatic prevention of aircraft collisions. The guidance commands can be computed on the ground, as part of the air traffic control function, or in the air, by means of an independent airborne collision avoidance system. The general problem is divided into three parts: (1) the determination of the most effective maneuvers required for avoiding the conflict; (2) the development of computer algorithms to estimate the relative state of a threatening aircraft from noisy measurements, and to generate the evasive maneuvers based on these estimates; and (3) the determination of the effect of dynamic and measurement errors on the performance of the system.

759. Sorensen, J.A., et al

Horizontal Collision Avoidance Study.

Institute of Navigation, Annual Meeting, 29th, St. Louis, Mo., June 19-21, 1973, Paper 25p.

The third-order relative dynamics of two conflicting aircraft are used to determine the horizontal maneuvers which produce maximum miss distance for arbitrary initial conditions and classes of aircraft. These maneuvers are then modified to determine a horizontal maneuver strategy which yields a safe miss distance and minimum deviation off course. Filtering techniques are examined which can be used to process noisy signals if the data required to mechanize the horizontal maneuvers are not fully available.

760. Sorensen, J.A. et al

Horizontal Collision Avoidance Systems Study.

Systems Control, Inc., under contract to DOT, Transportation Systems Center FAA Report RD 73-203 (TSC-73-36) December 1973. 262p. AD/A-004 536

This report presents the results of an analytical study of the merits and mechanization requirements of collision avoidance systems which operate chiefly by commanding horizontal maneuvers. The horizontal maneuvers are determined which provide an appropriate combination of miss distance, off-track

deviation, and initial relative range for aircraft with arbitrary turn rate limits and airspeeds. Comparison of horizontal maneuvers to vertical maneuvers and speed control are made with respect to measures of airspace usage. The effects of measurement errors on the statistical performance of a typical horizontal collision avoidance system are numerically computed. The sensitivity of airspace usage, probability of collisions, and probability of false alarms to variations in several system parameters are presented. (The author.)

761. Soward, R.M.

Some Trends In Air Traffic Control

In: Handling the Air Traffic of the Long-Term Future: 19th Technical Conference, International Air Transport Association, Dublin, October 23-28, 1972. Montreal, Canada, IATA, 1973? WP-47 24p.

This paper reviews briefly some past and possible future changes in the characteristics of air traffic likely to affect the severity of ATC problems over Western Europe. It then discusses some trends in ATC concepts of airspace organisation and ground systems which may be expected to influence traffic handling capabilities in the 1980's. Discusses separation between parallel routes.

762. Spencer, N.A. et al.

Assessment of the Performance of an Active ATCRBS Mode for Beacon Collision Avoidance.

Mitre Corporation, METREK Division Contract DOT-FA69NA-162 Report RD 77-151 (MTR-7645) October 28, 1977 135p.

The active ATCRBS Mode of BCAS was tested in a NAFEC airborne test bed. After conducting many flights for purposes of the system shakedown, design refinement, and the setting of parameters, a series of detailed data collection flights was run. The report presents first, the results of approximately 100 one-on-one aircraft encounters in which the ability of BCAS to give a proper maneuver command was examined; second, the results of one and one-quarter hours of data of targets-of opportunity in the environment of the Washington, D.C. TCA; and third, an examination of flights with a controlled target aircraft in the airspace near NAFEC to explore the effects of antenna coverage. A comparison is made between the results obtained in Washington, those from NAFEC flights, and those from simulated scenarios fed into the operating processor.

763. Stark, R.

3-D Representation of Processed Radar Data.

In: Symposium on Radar Technology, Munich, West Germany, November 13-15, 1974, Reports. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. p. 207-219, 221-231. In German. A75-46984

The paper describes preliminary work on a method of displaying to the pilot a three-dimensional display of the airway situation before him. Data acquired onboard are used. The system will indicate airway branching and give collision warning.

764. Statistical Analysis of the Results of the Main Data Collection in 1972.

ICAO Review of the General Concept of Separation (RGCSP Panel) Second Meeting WP/26 October 1973 65p.

This paper gives the results of a first analysis of the data collected by Paris SSR during the summer and autumn of 1972. A synopsis of most of the data and the method of data reduction is given. Recommendations for additional effort in reducing the data are made.

765. The Status of the PWI.

AOPA Pilot vol. 17, no. 4, p. 96, 99, 102-103 April 1974

After two decades of research, there exist only two PWI systems available to the general aviation pilot. One PWI, manufactured by Genave, of Indianapolis, Ind., and costing $395, picks up transponder signals from nearby aircraft. Light and sound warnings alert the pilot to stop whatever else he may be doing and start scanning for the intruding aircraft. The second PWI, expected to be available the spring of 1974, is manufactured by Rock Avionics Systems of New York, N.Y. The Rock device detects the infrared emissions from aircraft strobe lights. Rock's $1,495 PWI limits its scan to an area extending in a 120-degree arc on each side of the nose and within a vertical wedge 10 degrees above and below the airplane. Addition of an optional tail seeker, which provides a 360-degree scan, costs another $649.

766. Steele, Ernest R.

Improved Satellite Aided Vehicle Avoidance System. Patent Application

NASA-Case-ERC-10419 US-Patent-Appl-SN-219722 January 1972 31p. N72-21631

An improved satellite aided vehicle avoidance system (SAVAS) is described. The exact range from a protected vehicle to an intruding vehicle with mutual-collision heading and velocity is derived without signal transmission by the protected vehicle or use of synchronized time reference devices. Additional steps of measuring time-to-collision from the delay and Doppler measurements, establishing ordered time-slots from the form of the satellite signal may be included.

767. Steere, Marty

Near-miss!

TAC Attack vol. 16, p. 24 — 25 June 1976

768. Stein, Kenneth J.

Collision Avoidance System Tests Set.

Aviation Week & Space Technology vol. 105, no. 1, p. 59, 61, 63, July 5, 1976

Review of the Litchford B-CAS adaptive beacon-based system. Litchford calls his system "adaptive," because it automatically adjusts to the air traffic control environment, working in one of three modes:

1. Passively in dense traffic areas that are usually covered by multiple ATC radars soliciting replies from airborne transponders
2. Semi-actively when only a single secondary surveillance radar (SSR) beam is present, with the B-CAS system producing an active ranging signal that is used in conjunction with the SSR beam to process data.
3. Actively during operation in remote areas, where no SSR signals are received. Remote from all SSR stations, the system can still derive active range and range-rate data and evaluate closing criteria.

769. Stein, Kenneth J.

VFR Proximity Alert Readied for Market.

Aviation Week & Space Technology vol. 99, no. 24, p. 61, December 10, 1973

Refined version of a low-cost infrared proximity warning indicator system designed for general aviation aircraft operating under VFR conditions is being readied for the markets by Rock Avionics Systems, Inc., with first deliveries planned in January. The system, which responds to infrared energy emitted by aircraft strobe lights, was developed originally by Loral Aircraft Systems, and demonstrated nearly 3 1/2 years ago.

770. Stepner, D.E.

Modeling of Aircraft Position Errors with Independent Surveillance.

AIAA Paper 73-162 January 1973 9p.

In order to reduce present air traffic separation standards, a means of quantitatively measuring the safety level of a particular air route structure must be established. The most important factor in determining route safety is the distribution of aircraft position errors about their intended tracks. This paper presents a modeling technique which can compute the distribution of position errors as the aircraft proceed along the route. The technique takes into account not only the time dependence, but also all the factors influencing an aircraft's position errors, e.g., surveillance and navigation errors, surveillance fix rate, and Air Traffic Control procedures.

771. Stewart, A.C. et al

Electromagnetic Compatibility Measurements and Analysis of Systems in the 1,535-1,660 MHz Band.

Institute for Telecommunication Sciences, Office of Telecommunications Contract DOT-FA73WAI-323 FAA Report RD 75-229 January 1976 445p. AD-A024 430 N76-29445

Laboratory measurements were performed on a number of systems operating in the 1,535-1660 MHz band to determine electromagnetic compatibility. Among those tested were three proposed air-to-air Collision Avoidance Systems (CAS) operating in the 1,592.5 - 1,622.5 MHz band. The measurements revealed a distinct incompatibility between the three proposed CAS's and the three radar altimeters; therefore, further analysis was performed to determine the effects of altimeter interference to CAS in an operational environment.

772. Stodola, E.K.

Visual Collision Avoidance in High Speed, Low Altitude Testing and Training Operations.

Dikewood Industries, Inc. under contract to Air Force Special Weapons Center Report AFSWC-TR-76-1 April 1976 19p. AD-A024 844 N77-13026

A simplified quantitative consideration of visual collision avoidance by aircraft substantially faster than the possible collision hazard aircraft indicates that judgments of collision potential and of avoidance maneuvers can be based on simple viewing angles rather than time consuming estimates of the rate of movement of the line of sight (relative bearing rate) to the

other aircraft. In altitude change evasion maneuvers, the fast aircraft has much greater potential for climb than does a slow aircraft and, in general, should climb rather than descend.

773. Stone, R.B.

Pilot Error Accidents in Airline Jet Aircraft.

In: Economics of Air Safety and Long-Range Safety Research and Development: Proceedings of the Twenty-Sixth Annual International Air Safety Seminar, Lisbon, Portugal, November 4-7, 1973. Arlington, Va., Flight Safety Foundation, Inc., 1973. p. 59-64

Some 74 accidents were selected from a total of 200, after exclusion of taxi accidents, clear air accidents and near-miss accidents, in a computer analysis of common traits in U.S. airline jet pilot accidents over the period from 1958 to 1970. A breakdown of causes of the accidents is given, including 12 training accidents, 7 midair accidents, and other, 'off-profile flying', accidents comprising the rest.

774. Story, Anne W.

An Indicating System for Aircraft. Patent Application.

NASA-Case-ERC-10226-2 US-Patent-Appl-SN-124909 March 16, 1971 18p. N72-21008

US Patent 3,708,671 January 2, 1973 8p. N73-16483

A pilot warning indicator system is disclosed which includes a flashing beacon, a detector, and an indicating panel on each aircraft. The detector responds to radiant energy from another aircraft's beacon by energizing particular signal lamps positioned in the periphery of the pilot's normal field of view. Since the positions of the energized lamps are related to the direction from which radiant energy is received by the detector, the pilot is apprised of the relative position of an intruder aircraft without any shift in visual fixation.

775. Stratton, A.

Safety and Air Navigation.

Journal of Navigation vol. 27, p. 407-443; Discussion, p. 444-449, October 1974

To identify the navigation contribution to air accidents with certainity requires a detailed examination of the events in 'collision' types of accidents; this is only practical on a

sample basis. Examination of statistical trends over long periods has necessarily been confined to listed midair collisions and collisions with high ground, in both of which a high probability of 'navigation' content may be presumed. When comparison is required with the growth of air traffic this is confined to the readily available data on ICAO-scheduled passenger flights.

776. Study of the Integration and Evaluation of Air Traffic Control Systems in an Aeronautical Satellite System.

Societe d'Etudes des Systems d'Automation. SESA-Ex-5030/14639/71
November 18, 1971 2 vols. N77-25139 and N77-25140

An analysis of a system using aeronautical satellites as a means of providing an air traffic control facility in the North Atlantic (Aerosat system) is presented. A system is proposed consisting of a ground station network and two aeronautical satellites. The flight path structure and oceanic control intervention modes are discussed. A theoretical study on the reduction of separation standards is reported.

777. Sulzer, Richard and Skelton, Gerald E.

Visual Attention of Private Pilots, the Proportion of Time Devoted to Outside the Cockpit

FAA, NAFEC Project No. 051-242-050 Report RD 76-80 (NA75-28)
May 1976 25p.

The direction of the pilot's visual attention was recorded during three series of flights in a small aircraft. It was found that pilots using visual flight rules (VFR) spent approximately 50 percent of the time looking outside the cockpit, an airsearch time much higher than previously recorded for air-carrier cockpits. The remainder of the time, while occupied in the cockpit, the pilot might be likely to miss seeing an approaching aircraft. Hence, a test environment for pilot warning systems intended to aid visual detection of potential threats should employ a pilot workload that produces a realistic proportion of visual attention available for outside search.

778. Supreme Court Asked To Review Two Midair Crash Cases.

Aviation Daily vol. 218, no. 22, p. 175, April 1, 1975

The cases involved a 1969 midair collision between an Allegheny DC-9 and a Piper Cherokee near Indianapolis, Ind.

779. Swett, Charles F.

A Design Concept for an IPC Airspace Protection Capability.

Mitre Corporation, Contract DOT-FA70WA-2448 Technical Report MTR-7247 July 1976 35p.

In an effort to further exploit the potentials of the DABS-IPC system, additional services for the aviation community are being investigated. These services include terrain avoidance, obstacle avoidance and observance of special airspaces. This report presents a design concept for the airspace observance function.

780. Symington, James W.

Remarks before the House of Representatives on Friday, June 30, 1972, regarding Aircraft Collision Avoidance System.

Congressional Record vol. 118, no. 108, Part II, p. E 6693, June 30, 1972

Discusses the method of paying for the cost of installing McDonnell Douglas EROS in commercial planes. Requests the government by law to require the installation of CAS throughout America, and encourage the adoption of compatible systems throughout the world.

781. System Errors.

Business & Commercial Aviation vol. 33, no. 1, p. 66, July 1973

In April 1973 a NASA Convair 990 and a Navy P-3C Orion collided on short approach to Runway 32 Right at Moffett Field, California. NTSB has said the cause was an ATC error. The tower operator mistakenly called the wrong runway.

782. Systems Control, Inc.

Oceanic ATC Surveillance Systems Study.

Contract DOT-TSC-260-2 Report FAA-RD-73-8 February 1973 209p.
AD 758 240 N73-20719

Using route safety or collision risk as the performance measure it is shown that with all aircraft equipped with INS the lateral separation standard can be reduced from 120 n.mi. and the longitudinal standard from 15 to 10 minutes. If an independent surveillance system is included, the lateral separation can be further reduced to 30 n.mi.

773. Taillet, J.

Requirements and Trends in Collision Avoidance.

Association Aeronautique et Astronautique de France and Union Syndicate des Industries Aeronautiques et Spatiales, Congres International Aeronautique, 11th, Ecole Nationale Superieure de Techniques Avancees, Paris, France, May 21-23, 1973. Paper 32p. 20 ref. In French.

The aims of collision avoidance systems are reviewed, and various imperative conditions are given which will have to be met before systems now under development can pass into the operational stage. Principal criteria considered are reliability, precision, cost, and compatibility with ground control systems. The systems proposed by the principal manufacturers are described, and their operational principles are analyzed.

784. Taillet, J.

Requirements and Trends of Collision Avoidance Systems.

L'Aeronautique et l'Astronautique, no. 43, 1973, p. 9-19. In French.

Following a review of the objectives of anticollision systems in the course of development, in the light of problems posed by their exploitation, definition is given to the imperative conditions which must be satisfied to pass to the operational stage. A certain number of criteria, bearing mainly on reliability, accuracy, price, and compatibility with ground control are formulated. The systems proposed by the principal constructors are briefly described and their principle of operation is analyzed. AIAA-74-23393

785. Tanner, F.S.

International Airline Views on the United States' Plans for the Upgraded Third Generation System.

In: Upgrading the ATC System: Proceedings of the Annual Meeting, Washington, D.C., November 28, 29, 1973. Washington, D.C., Radio Technical Commission for Aeronautics, 1973. 6p.

Attention is given to improved VOR/DME, the increased automation of the controller functions of conflict prediction and resolution, automatic intermediate positive control, the implementation of close-spaced, dual-lane runways, and the discrete address beacon system.

786. Telsch, R. and Parker, L.

Intermittent Positive Control Message Rate Analysis.

Mitre Corp. Contract DOT-FA70WA-2448 Technical Report MTR-6454
July 19, 1973 36p.

An analysis of IPC message rates implied by the baseline IPC algorithms has been performed. Message rates were determined using the Los Angeles Basin Standard Traffic Models for 1972 and 1982 and the 1995 Los Angles model generated in the Advanced Air Traffic Management System B study.

787. Telsch, Richard W.

Computer Processing Estimates For Phase I Intermittent Positive Control.

Mitre Corporation Contract DOT-FA70WA-2448 Technical Report MTR-6778
December 1974 58p. CONTROLLED DISTRIBUTION

788. Telsch, Richard W.

Interface to FORTRAN Test Bed Intermittent Positive Control Package.

Mitre Corporation Contract DOT-FA70WA-2448 Report MTR-6656 April 1974
27p.

This report describes the internal software interface between the FORTRAN implementation of the Intermittent Positive Control algorithms developed by Mitre and the Digital Simulation Facility at NAFEC. The scope of the IPC system model is discussed. Interface linkages and the structure of the software package are described.

789. Ten Have, J.M. and Scholten, C.G.H.

Conflict Detection and Resolution in the Netherlands ATC-System SARP-II.

International Council of the Aeronautical Sciences, Congress, 10th, Ottawa, Canada, October 3-8, 1976. ICAS 76-55 10p.

National Aerospace Lab., Amsterdam NLR-MP-76016-U June 15, 1976, 12p.
N77-25144

The paper focuses on two conflict detection methods which are developed for overflying aircraft in the Netherlands airspace and are based on long-term trajectory predictions. The aim is that the conflict detection programs produce few 'false alarms' and consume very little on-line processing time. This is met by the so-called 'block method' which is described in this paper. Also investigations are discussed with respect to a more complicated method, known as the 'critical-distance method'. The latter method will reduce the false alarm rate

to its minimum value, set by the uncertainties in the trajectory predictions in the ATC-computer system and by the lateral deviations from track of the aircraft.

790. Theberge, Norman

The Impact of a Proposed Active BCAS on ATCRBS Performance in the Washington, D.C., 1981 Environment.

DOD Electromagnetic Compatibility Analysis Center Contract FA70WAI-175, Task 32-A-1 FAA Report RD 77-140 (ECAC-PR-77-037) September 1977 48p.

A computer model of the proposed active BCAS was developed to investigate the impact on ATCRBS ground system. Two ground environments were simulated, an all-ATCRBS environment and a 25%/75% DABS, ATCRBS mix. Airborne fruit rates and the effect of BCAS/DABS mode power programming on interference were predicted.

791. Thompson, William M.

Anatomy of a Midair.

Aerospace Safety vol. 30, no. 2, p. 16, 17, February 1974

A midair accident described where the crews had ample aural clues to alert them to collision potential. The crews failed to "be aware of" and avoid. They didn't look because they hadn't listened.

792. Time to Check Anticollision Lights.

AOPA Pilot vol. 15, no. 11, p. 46-47, November 1972

Whelen Engineering graphically shows night flight requirements.

793. Toerper, K.E.

MINICAS Field Acceptance Test Results.

McDonnell Douglas Electronics Company Contract DOT-FA73WA-3239 Report RD 75-224 December 1975 40p. AD-A021 686 N76-23238

This report includes analyses of communication reliability, time synchronization accuracy, range rate accurancy and CAS-threat response for a limited sample of acceptance test data.

794. Toerper, K.E.

Time/Frequency Collision Avoidance System Equipment. Phase I -- Development Model Ground Station and Associated Airborne Feasibility Models.

McDonnell Douglas Electronics Company Contract DOT-FA73WA-3239 Report RD 75-223 December 1975 135p. AD-A021 685 N76-23188

Work performed at MDEC is described and included: system analysis, design and development, fabrication and assembly integration and test and documentation. Activities at NAFEC are described and included, field training, preliminary functional tests, installation, and field acceptance test. Appendices present the results of antenna measurements and reliability/maintainability studies.

795. Tosic, Vojin and Horonjeff, Robert

Models for Estimating Runway Landing Capacity with Microwave Landing System (MLS).

California Univ., Institute of Transportation and Traffic Engineering. NASA-CR-137 746 September 1975 204p. N75-32084

A model is developed which is capable of computing the ultimate landing runway capacity, under ILS and MLS conditions, when aircraft population characteristics and air traffic control separation rules are given. This model can be applied in situations when only a horizontal separation between aircraft approaching a runway is allowed, as well as when both vertical and horizontal separations are possible. Results suggest that an increase in runway landing capacity, caused by introducing the MLS multiple approach paths, is to be expected only when the aircraft population consists of aircraft with significantly differing approach speeds and particularly in situations when vertical separation can be applied. Vertical separation can only be applied if one of the types of aircraft in the mix has a very steep descent angle.

796. Traffic Control Procedures Hit In Near Midair.

Aviation Week & Space Technology vol. 105, no. 15, p. 72, October 11, 1976

NTSB has determined the probable cause of a near midair collision of a Hughes Airwest McDonnell Douglas DC-9 and a Northwest Airlines McDonnell Douglas DC-10 near Spokane International Airport on April 1, 1976 to be the inadequacy of local air traffic control procedures.

797. Trammell, Archie

The Civil/Military Collision.

Business & Commercial Aviation vol. 36, no. 5, p. 79, May 1975

The author believes that not all near misses with the military are happenstance, but rather deliberate high speed passes. He suggests that, by law, military operations should be confined to those thousand of square miles of airspace blocked off from civil use for that purpose.

798. Trammell, Archie

Collision-Avoidance.

Business & Commercial Aviation vol. 32, no. 5, p. 64, May 1973

It is evident that pilots and crews are going to have to rely on see-and-avoid plus their wits. The technique is simple -- know when to look out, where to look and what sort of collision threat will most likely be seen; head-on, overtaking or converging.

799. Trammell, Archie

Midair Collisions.

Business and Commercial Aviation vol. 38, no. 1, p. 96-97, January 1976

Discusses the lessons to be learned by general aviation pilots from the accident between a Cessna 150 and a Twin Otter commuter over Whittier, California, in which 14 people were killed. A traffic report was given to the Otter crew two minutes before impact. Learn to scan, be extra vigilant, be professional, creative and intelligent.

800. Trammell, Archie

Which Shall It Be: CAS, IPC, BCAS, GPS, or IMLS?

Business and Commercial Aviation vol. 38, no. 5, p. 9, May 1976

Beginning 50 years ago and extending well into the 20's the U.S. has not progressed much. Technologically, we have become quite sophisticated, but in concept we're still basing our navigational system on bonfires strung across the country.

801. Transponder Use Urged by Safety Board.

Air Line Pilot vol. 41, no. 6, p. 32, June 1972

Following its study of a midair collision involving an Eastern Air Lines DC-9 and a Cessna 206 at Raleigh-Durham, N.C., Airport on December 4, 1971, the National Transportation Safety Board has recommended that FAA require pilots of transponder-equipped aircraft to operate transponders "Whenever VFR operations are conducted into or in proximity to, an airport served by a radar approach facility."

802. Turnock, Theodore J., Beaty, James S. and Lasewicz, Vincent J.

Flight Test Outline for Evaluation of MDEC Collision Avoidance System.

FAA, NAFEC, Air Traffic System Division Test Plan Project No. 052-241-010 April 11, 1975 109p.

The flight test program will be conducted in such a fashion that a comparison of results can be made with the flight test program of the SECANT-CAS and AVOID-CAS conducted by the Naval Air Development Center under agreement with the DOT. NAFEC will conduct similar testing of the McDonnell Douglas Electronics Company (MDEC) system.

803. Turnock, Theodore J., Scozzafava, Henry, Wojciech, John J. and Culbertson, Kent T.

Flight Test and Evaluation of MDEC (McDonnell Douglas Electronics Corporation) Collision Avoidance System.

FAA, NAFEC Project No. 052-241-000 Report RD 75-231 (NA 76-23) February 1977 274p. AD-A037 435 N77-25126

The report covers the test and evaluation of commercial and general aviation versions of airborne collision avoidance system (ACAS) equipments which are candidates for selection in a National Standard Collision Avoidance System. It is concluded that the CAU and Mini-CAS equipments perform the collision avoidance function as described in ANTC 117.

804. Tyler, J.S., Stepner, D.E. and Sorensen, J.A.

An ATC/Surveillance Modeling Approach for Specifying Lane Separation Standards.

In: AGARD CP-105 Air Traffic Control Systems. Papers presented at the 14th Meeting of the Guidance and Control Panel of AGARD held in Edinburgh, Scotland, 26-29 June 1972. Paper 10-1 to 10-12

Lane separations cannot be system improvements to the extent that an accepted level of safety is compromised. This paper considers the overall problem of relating lane separations to safety (collision risk) for different navigation systems, surveillance systems, and ATC procedures. A model is described which has the same general input/output format as the well-known Reich model that has been used for specifying North Atlantic route separations. However, two significant extensions to the Reich model are included: (1) the time-varying nature of the aircraft position errors (and therefore collision risk) is modeled, and (2) the capability of including an independent surveillance system is modeled.

805. Tymczyszyn, J.P.

Intermittent Positive Control.

In: NEREM 74; Northeast Electronics Research and Engineering Meeting, Boston, Mass., October 28-31, 1974, Record. Newton, Mass., Institute of Electrical and Electronics Engineers, Inc., 1974. Part 1, p. 26-29.

Describes this totally automatic ground-based system which provides collision avoidance service to aircraft. Results of Monte Carlo simulation tests of the IPC algorithm are discussed and cost estimates are presented.

806. Under Control.

Flight International vol. 111, no. 3556, p. 1231, May 7, 1977

Nowdays, although pilot is legally responsible for the safe navigation of his aircraft, he has to put almost blind faith in the air traffic control system. Responsibility for separation will always lie with ATC., but pilots should have some means to double-check it.

807. United Kingdom

The Derivation of Target Levels of Safety for Use in the Assessment of Separation Values in Use in Route Structures Designated by ATC Authorities.

ICAO NAT/SPG9-WP/7 May 1973

The present document follows RGSP-BID/2 of January 1971 closely in form and scope. The changes made fall into two categories: first, those arising from the general updating of the statistical material used in BID/2, and second, those consequent upon the modification of some BID/2 assumptions and data specifically related to the North Atlantic environment.

808. United Kingdom

The Derivation of Target Levels of Safety for Use in the Assessment of Separation Values in Use in Route Structure Designated by ATC Authorities.

ICAO RGCSP-WP/28, Second Meeting RGCSP, October 1973 29p.

This paper follows the work done by the U.K. for NAT/SPG for the May 1973 meeting. The differences amount to an updating of statistical data and the environment which is different from the North Atlantic.

809. United Kingdom

Navigational Performances of Aircraft Operating in the NAT Region.

ICAO NAT/SPG9-WP/5, May 1973

Describes in some detail current methodology for the acquisition of data on navigational performance related to traffic emerging at the Eastern boundary of the Organized Track structure.

810. United Kingdom

Performance of Inertial Navigation Systems -- NAT Region.

ICAO NAT/SPG9-WP/15 May 1973

The purpose of this paper is to examine the achieved navigation performance of aircraft equipped with INS on NAT routes. In addition, the possibility of applying reduced separation minima in an environment in which all aircraft are INS navigated is assessed.

811. United Kingdom

Supersonic Transport Aircraft -- Lateral Spacing of OAC Tracks.

ICAO NAT/SPG9-WP/33 June 1973

The purpose of this WP is to provide an appraisal of the current situation with regard to the lateral separation of aircraft in the light of information relating to forecast traffic over the NAT region and the proposed system installations.

812. United Kingdom

Supersonic Transport Aircraft --- Longitudinal Separation OAC Region.

ICAO NAT/SPG9-WP/32 May 1973

The purpose of this WP is to examine the proposals presented at the NAT SPG5 in the light of subsequent information on aircraft performance and navigation capability.

813 U.S. Congress. House of Represenatives. Committee on Government Operations. Transportation Subcommittee

Near Midair Collisions between Military and Civilian Aircraft.

Hearing, 94th Congress, Second Session, April 1, 1976 Wash., D.C., GPO, 1976 33p.

Statement of Rear Adm. W.P. Lawrence, Director, Aviation Programs Division, Office of Chief of Naval Operations concerning the military aircraft near midairs with civilian -- especially off the Jacksonville, Fla., area. The Navy has instituted a program to establish fleet area control and surveillance facilities, with the acronym FACSFAC. Appendix has Resume of Investigation of Alleged Unauthorized Intercepts of Civil Aircraft by Military Aircraft as presented by some controllers in the Jacksonville, Fla., area.

814. U.S. Congress. House of Representatives. Committee on Science and Technology.

Authorizing Appropriations to the Federal Aviation Administration for Research and Development.

95th Congress, 1st Session Report No. 95-95 March 18, 1977 58p.

Airborne Separation Assurance Program allocated $5,445,000, Airborne Beacon Avoidance System -- $336,000. Appended to the report are additional views of Hon Barry Goldwater, Jr. in which he discusses the FAA proposals for CAS.

815. U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation.

Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972 264p.

Inquiry into the subject of midair collision avoidance, and a study of Government and industry efforts to reduce the risk of such occurrences in the future. Particularly interested in hearing testimony on legislation introduced by Senate bill S. 2264, which would require the development and universal installation of a collision avoidance system within the next 5 years.

816. United States Delegation

Composite Separation

ICAO Asia/PAC RAN Meeting WP/78 9 June 1973 38p.

This is the United States' plan to justify composite separation on the Central East Pacific's track structure. The data collection requirement and a description of the type of data is given. The risk analysis methodology to be used is identified (Reich). A cost/benefit analysis is outlined and a schedule for the project is set forth.

817. U.S. General Accounting Office. Comptroller General of the United States.

Aircraft Midair Collisions: A Continuing Problem. -- Report to Congress.

B-164497(1) October 23, 1974. 36p.

The report recommends an analysis of all alternative solutions to the midair collision problem and the FAA in expediting its evaluation programs of airborne collision avoidance systems.

818. Upgrading the ATC System; Proceedings of the Annual Meeting, Washington, D.C., November 28, 29, 1973. Meeting sponsored by the Radio Technical Commission for Aeronautics. Washington, D.C., RTCA, 1973. 221p.

An evaluation of the upgrade third generation ATC system is considered, giving attention to the report of the Air Traffic Control Advisory Committee, plans for intermittent positive control, VORTAC improvements, collision avoidance systems, and a universal data link. Other subjects explored are related to international views of the upgraded third generation system and microwave landing systems.

819. Vickers, Tirey K.

Developments in Collision Avoidance.

The Controller vol. 11, no. 1-4, p. 93-96, December 1972

A reprint of an article which appeared in the April 1967 issue. Review of the National Air Meeting on Collision Avoidance, Dayton, Ohio, February 1967. The meeting was a progress report on Air-Derived Separation Assurance (ADSA). It covers four different areas: Visual capabilities (human factors for unaided visual detection); passive visual enhancement (aircraft paint and lights); visual avoidance aids (pilot warning instruments - PWI); Non-Visual Avoidance Systems (collision warning systems -- CAS).

820. Vickers, Tirey K.

USSR Separation Standards.

Journal of Air Traffic Control Vol. 16, no. 4, p. 16--23, July-August 1974

In comparison with U.S. separation standards, many of the Soviet standards seem extremely conservative -- especially those dealing with vertical separation at high altitudes, and those dealing with lateral and longitudinal separation under enroute radar control. How much of this conservatism is due to deficiencies in altimetry, navigation, surveillance, communications, or controller training, we do not know.

821. Villa, G.F.

Problems of Air Collision Avoidance Involving Air Traffic in Italy.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germancy, October 2-5, 1975. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 2 12p.

The paper is based on research performed both in Italy and abroad relevant to problems connected with aircraft collision probability. The major of the research works are based on parameters derived or to be derived from statistical measurements of air traffic intensity and type over the areas taken into consideration. The paper suggests that coordinated statistical measurements should be carried out on the air traffic in order to have them ready when the anticollision problems will be so great as to influence the air traffic intensity. It is forecast that such an influence will represent a great limitation in the air traffic for the near future.

822. Vincent, T.L. et al

Some Aspects of Collision Avoidance.

A I A A Journal vol. 12, no. 1, p. 3-4 January 1974

Some aspects of the problem of collision avoidance for two vehicles are examined by hypothesizing certain rationales for the vehicle operators and then computing the sets of initial conditions for which collision can occur.

823. Vincent, Thomas L. et al

A Problem of Collision Avoidance.

Arizona Univ., Engineering Experiment Station Report No. EES-SER-39
NASA-CR-129988 November 1972 86p. N73-14701

Collision avoidance between two vehicles of constant speed with limited turning radii, moving in a horizontal plane is investigated. Collision avoidance is viewed as a game by assuming that the operator of one vehicle has perfect knowledge of the state of the other, whereas the operator of the second vehicle is unaware of any impending danger. The situation envisioned is that of an encounter between a commercial aircraft and a small light aircraft. Three different zones of vulnerability are defined and the boundries or barriers between these zones are determined for a typical aircraft encounter.

824. Wachsman, H. A.

Air Traffic Conflict Prediction and Resolution.

In: Navigation for General Aviation and Navigation Training; Proceedings of the National Air Meeting, Atlanta, Ga., February 29-March 2, 1972. p. 83-86

In a continuing effort to further increase the safety of the National Airspace System, the FAA is engaged in a broad investigation of collision avoidance techniques which promise the reduction of the midair collision threat. The on-going development and evaluation includes air-borne systems which require avionics installation in aircraft, and ground-based methods which require refinement of existing subsystem capabilities. The development of such a ground-based system was contained in the recommendations of the Air Traffic Control Advisory Committee, and is named a 'Safety/Separation' Service.

825. Wayne, Daniel G.

Guidelines for the Development of High-Intensity Anti-Collision Strobe Light Systems. Volume IV. EMI Test Results of Two Commercial Strobe Lights Tested Against MIL-STD- 461/462A (U)

Naval Avionics Facility Report NAFI-TR-2129, Vol. 4 June 30, 1976
146p. AD-BO15 944L (USGO)

Vol. 1. See, Willenbrock, John C.
2. See, Willenbrock, John C.
3. See, Higbie, Thomas E.

826. Weather Deterioration Led to Collision.

Flight International vol. 111, no. 3556, p. 1246, May 7, 1977

Summarizes a report from the Department of Trade's Accidents Investigation Branch, England, AAR 16/76. A rapid deterioration in local weather was a major factor in a collision between two student pilots flying Cessna 150s. The accident in which one pilot was killed and the other seriously injured occurred over Scotland in November 1975.

827. Weber, Otto

Statistical and Flight Mechanical Studies on Visual Conflict Detection and Resolution in Civil Aviation.

Deutsche Forschungs- und Versuchstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik Report DLR-FB-75-71 November 1975 122p. In GERMAN; ENGLISH summary N76-20108

Theoretical studies in the field of statistics and flight mechanics concerning conflict detection and resolution by the 'see and avoid' concept were made. American and German statistics on midair and near midair collisions are discussed. For flights without acceleration basic geometrical and physical aspects of conflict detection are derived and details on the angles of vision from the pilots of the other aircraft and on 'dead zones' are given. Horizontal evasive maneuvers are analyzed in detail and their effectiveness is presented in graphs which can be used for numerous tasks. Two observation error models are described and the influences on the distances where horizontal evasive maneuvers are possible are estimated. Vertical maneuvers are treated concisely and some tentative suggestions for the improvement of flight safety are made. Author

828. Weber, Otto

Statistical Studies on Dynamic Zones of Protection During Horizontal Evasive Maneuvers.

Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany) Inst. fuer Flugmechanik. Report No. DLR-FB-76-51 September 23, 1976 48p. In GERMAN N77-20054 AD-B016 434 (DDC Users Only)

829. Weeghman, Richard B.

Ground Watch -- FAA's Collision Avoidance Surprise.

Profile, Goodyear Aerospace vol. 10, no. 1, p. 4-5, Spring 1972

Reprint of Editorial from Air Progress, February 1972. Associative Array Processor (a ground radar computer) by Goodyear Aerospace works along with the FAA's automated radar tracking system (ARTS) and is being tested at Knoxville, Tenn.

830 Weiss, H.G.

The Discrete Address Beacon System for Air Traffic Control.

In: National Telecommunications Conference, New Orleans, La., December 1-3, 1975, Conference Record. N.Y., IEEE, 1975 Vol. 1, p. 14-19 to 14-22

An evolutionary upgrading of the Air Traffic Control Radar Beacon System (ATCRBS), incorporating a discrete address and two-way data-link capability, is currently underway under an FAA sponsored development program. This new system, called DABS, includes a very flexible, adaptive data-link that is designed to grow modularly to accommodate a variety of levels of service for the different classes of users. Development equipment has been flight-tested and, when DABS is introduced in the early 1980s, will lead to increasing levels of ATC automation and safety.

831. Weiss, H.G. and Drouilhet, P.R.

The Discrete Address Beacon System /DABS/.

In: NEREM 73: Northeast Electronics Research and Engineering Meeting Boston, Mass., November 6-8, 1973, Record. Newton, Mass., IEEE, 1973. Part I. p. 208-211

The current status in the ongoing development of the DABS is reviewed. Following a description of the system and of its functions in air traffic control, the data link capability requirements of the system are examined and individual elements of the DABS surveillance and communication system are discussed. Special attention is given to transponders, the uplink and downlink format of the ground-air-ground link, and the DABS sensor.

832. Weiss, Herbert G.

Air Traffic Control. Quarterly Technical Report.

Massachusetts Institute of Technology, Lincoln Laboratory ESD-TR-72-57 February 15, 1972 20p.

The four areas under investigation are: radar MTI technology, airborne graphical displays, the influence of propagation effects on CNI system performance and the analysis of various Microwave Landing Guidance Systems.

833. Weiss, I.M. and Bellantoni, J.F.

A Comparison of Enroute Conflict Risk for Three 1995 Air Traffic Surveillance Systems.

In: Productivity: Proceedings of the Joint Automatic Control Conference, West Lafayette, Ind., July 27-30, 1976 N.Y., American Society of Mechanical Engineers, 1976 p. 89-99

This paper compares three surveillance systems on the basis of their effect on the manual enroute conflict rate and collision rate, estimated for a postulated 1995 traffic level. The three systems are an Advanced Air Traffic Management System based on satellite surveillance; the Upgraded Third Generation Air Traffic System based on an improved radar beacon system; and a system based on current surveillance radars. These three systems were characterized in this study by their surveillance accuracy and the results presented apply to any systems of equal accuracy.

834. Weiss, W.J.

Operational Concepts for Highly Automated Air Traffic Management Systems.

International Air Transport Association, 19th Technical Conference, Dublin, October 23-28, 1972. WP-11 9p.

Several alternative operational concepts which are being evaluated for an advanced Air Traffic Management System of the long term future are presented. A preferred hybrid concept which offers excellent potential for achieving a significant increase in system capacity and reduction in operating costs without degrading system safety is recommended for further analysis. This operational concept is oriented toward providing a feasible highly automated Air Traffic Management System and incorporating distributed airborne collision avoidance, centralized positive control and intermittent positive control into a single integrated system.

835. Wernicke, Joachim

The Quasi-Visual Flight: A New Navigation Concept.

Technische Univ., Inst. fuer Flugfuehrung und Luftverkehr Report-62 September 1971 37p. N72-27708 In GERMAN.

An air navigation system is described which uses the concept of interferometric measurements of signals received from microwave radio beacons on the ground and in other aircraft similarly equipped. The position of the aircraft as well as that of aircraft in the vicinity are shown on a display device. The pilot can thus initiate a collision avoidance maneuver. The advantages of such a system over present day air traffic control are stressed, especially freedom from fixed predetermined air routes and much shorter security margins. Costs of such a system are estimated and compared with those of present air traffic control in Germany.

836 Westcott, R.A.

Discrete Address Beacon System/Air Traffic Control Interface Configuration Document. Vol. I: Data Formats for Phase 1.

Mitre Corporation Contract DOT-FA69NS-162 Report FAA-RD-74-165 (MTR-4243) September 1974 67p. AD-A001 541 N75-18199

The interface data formats to be used for the DABS system/Intermittent Positive Control (IPC) testing and Control Message Automation (CMA) testing are defined. The formats are forwarded on the surveillance channel when a DABS interrogation of a transponder equipped aircraft occurs. Examples of the various formats are provided. Comparisons of the new message formats with previous formats are shown.

837. Wescott, R.A.

Discrete Address Beacon System/Air Traffic Control Interface Configuration Document. Volume II -- Enroute Hardware for Phase I.

Mitre Corp. Contract DOT-FA69NS-162 Report FAA-RD-74-165 vol. 2 (MTR-4243 vol. 2) September 1974 34p. AD-A009 307 N75-29081

The document defines the En Route hardware interfaces to be used for Phase I DABS/IPC testing and CMA testing involving NAFEC facilities and the Discrete Address Beacon System Experimental Facility (DABSEF).

838. Westcott, R.A.

Discrete Address Beacon System/Air Traffic Control Interface Configuration Document (Terminal Hardware for Phase I).

Mitre Corporation Contract DOT-FA69NS-162 Report FAA-RD-74-165 vol. 3 (MTR-4243, vol. 3) October 1974

This document defines the Terminal hardware interfaces to be used for Phase I DABS/IPC testing and CMA testing involving NAFEC facilities and the Discrete Address Beacon System Experimental Facility (DABSEF). It is intended that it provide the base line for Terminal interface hardware configuration control.

839. Wescott, Royal A.

Interface Definition DABS Engineering Model/ATC (NAFEC). Digital Simulation Facility Data Formats.

Mitre Corporation DOT Contract FA-69NS-162 FAA Report RD 74-159 (MTR-4221) Vol. II, Series 3 December 1975 39p. AD-A025 233

This document describes the formats of the simulated surveillance and communications messages for the interface between the Digital Simulation Facility (DSF) and the Air Traffic Control (ATC) facilities at NAFEC. The facilities which will be interfaced with the DSF are the NAS Enroute System in the System Support Facility (SSF) and the ARTS-3 System in the Terminal Automation Test Facility (TATF). These interfaces will be made available for use for Intermittent Positive Control (IPC) Phase 2 testing and other advanced ATC system test activities requiring the simulation of the DABS in the DSF.

840. Wescott, Royal A.

Interface Definition DABS Engineering Model/ATC (NAFEC) Terminal Hardware Configuration

Mitre Corporation Contract DOT-FA69NA-162 FAA Report RD75-159 vol. 4 (MTR-4221) vol. 4) November 1975 43p. AD-A025 234 N77-16007

The hardware interfaces described are required between the DABS Engineering Models to be installed at or near NAFEC, and the Terminal Automation Test Facility (TATF) at NAFEC. This interface will be used to support DABS development tests and the Upgraded Third Generation System Tests including the Intermittent Positive Control (IPC) Phase II tests.

841. White, J.S.

Landing Rates for Mixed STOL and CTOL Traffic.

NASA, Ames Research Center Report No. NASA-TN-D-7666 April 1974 76p. N74-21290

A study was made to determine the expected landing rate for STOL-only traffic and mixed STOL-CTOL traffic. The conditions used vary from the present day standards to an optimistic estimate of possible 1985 conditions. A computer program was used to determine the maximum landing rate for the specified conditions and aircraft mix. The results show that the addition of STOL on a CTOL runway increases the total landing rate if the STOL airborne spacing can be reduced by use of improved navigation equipment. Further, if both takeoff and landings are performed on the same runway, the addition of STOL traffic will allow an increase in the total operation rate, even with existing spacing requirements.

842. Whittaker, Philip N.

Statement of the Assistant Secretary, Department of the Air Force.

U.S. Congress. Senate. Committee on Commerce. Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems. Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C., GPO, 1972. p. 231-238.

While the DOD supports the objective of S.2264, they do not support the bill. It would not be feasible to complete development, select a system, and complete the implementation in time to comply with the provisions of the bill. They further believe that to force establishment of a national CAS standard within the deadlines specified in S.2264 would be a serious error.

843. Willenbrock, John C.

Guidelines for the Development of High-Intensity Anti-Collision Strobe Light Systems. (U)

Naval Avionics Facility Report NAFI-TR-2129 vol. I June 30, 1976 91p. AD-B015 941L (USGO)

For Vol. 2, See Willenbrock, John C.
Vol. 3, See Higbie, Thomas E.
Vol. 4, See Wayne, Daniel G.

844. Willenbrock, John C.

Guidelines for the Development of High-Intensity Anti-Collision Strobe Light Systems. Volume II. Analysis of Factors Concerning Strobe Light System Optimization and Design. (U)

Naval Avionics Facility Report NAFI-TR-2129 Vol. 2 June 30, 1976 153p. AD-B015 942L (USGO)

For Vol. 1, See Willenbrock, John C.
3, See Higbie, Thomas E.
4, See Wayne, Daniel G.

845. Willey, T.M. and Wingard, J.L.

Potential Interference of the Discrete Address Beacon System (DABS) on the X and Y Mode TACAN System.

IIT Research Institute Contract DOT-FA70WAI-175 Report RD 74-14 (ECAC - PR-74-003) February 1974 229p. AD-A003 795 N75-20284

The impact of ten proposed signal formats of the DABS on the performance of TACAN/DME equipments was investigated. The susceptibility of the individual TACAN/DME equipments to interference from the proposed DABS emissions was determined experimetally. This information was then used to assess the inter-

ference impact of a hypothetical DABS environment on the operation of TACAN/DME systems. Worst case characterizations were used in some respects. A set of frequency-distance separations was developed that would prevent DABS interference to the TACAN interrogator, and limit the generation of deadtime in the TACAN beacon.

846. Willis, K.

ARTS-III Enhancement Costs and Benefits.

METIS Corporation Contract DOT-FA74WA-3494 FAA Report AVP 75-3 September 1975 114p.

One of the purposes of the analysis described in this report was to define the sources of benefits provided by the ARTS III Enhancement Program. The functional automation capabilities which provide the benefits are:

Metering and Spacing
Minimum Safe Altitude Warning
Automated Flight Data Handling
Control Message Automation
Conflict Prediction and Resolution
Digital Radar Remoting
Continuous Data Recording
Improved Availability and Reliability

847. Wilson, J.G.

Conflict Prediction.

CATCA Journal vol. 4, p. 4-6, Fall 1972

Conflict search procedure starts at the conflict matrix, picks out a pair of aircraft, and determines if a potential conflict exists, what type of conflict it is, and whether it is, in fact, a conflict. The whole probe was written initially as a linear problem, and after debugging was converted to FORTRAN II. To test the design, it was unrealistically and deliberately loaded with altitude and time conflicts. The very encouraging result was that the complete cycle of route data input, table construction, flight plan data input, data base construction, conflict search, and conflict analysis took only 1.5 sec of CPU time.

848. Winter, Herbert

Optimal and Suboptimal Methods of Satellite Surveillance for Traffic Control of Transoceanic Flights.

Navigation vol. 18, no. 4, p. 417-424, Winter 1971-1972

It appears that a satellite surveillance system providing accuracies within 1000 meters standard deviation in each horizontal direction is quite feasible, and would therefore permit a considerable reduction in lateral and longitudinal separation of aircraft crossing the oceans.

849. Wisconsin Airliner -- Air Taxi Collision.

ATCA Bulletin no. 73-6, p. 9, June 1973

NTSB has determined that the probable cause of the midair collision of a North Central Airlines Convair 880 and an Air Wisconsin DeHaviland DHC-6, both of which were nearing destination airports when they collided at about 2,500 ft. over Lake Winnebago 29 June 1972, was the "failure of both flight crews to detect visually the other aircraft in sufficient time to initiate evasive action."

850. Wise, K.A.

DABS Is a Four Letter Word.

Journal of Air Traffic Control vol. 14, p. 9-11, September 1972

The development of the Discrete Address Beacon System was recommended in order to obtain garble-free replies, superior data quality, and the means for implementating a digital data link.

851. Witkin, Richard

Computers Aid Controllers in Averting Collisions.

New York Times Vol. CXXV, p. 31, Wednesday, December 3, 1975

Briefly describes the new computerized system being installed in the 20 ARTCCs. Also describes the near miss between the American Airlines DC-10 and TWA L-1011 which was saved by an alert Cleveland center controller.

852. Wright, T.M.B.

The Place of Time/Frequency and Space Technology in Relative Navigation.

In: Collision Avoidance and Rendezvous Navigation; Proceedings of the International Congress, Hanover, West Germany, October 2-5, 1973. Dusseldorf, Deutsche Gesellschaft fur Ortung und Navigation, 1974. Volume 1. 16p.

An employment of time-frequency techniques combined with the use of geostationary satellites might make it possible to provide for a wide range of vehicle types with single narrow-band equipment facilities for rendezvous maneuvers, collision avoidance methods, and docking maneuvers. Practical difficulties concerning the implementation of the considered approach are related to the development of a generally acceptable multiplexing technique which will permit high traffic capacities in the aviation and maritime applications.

853. Yang, Sun-maw and Feng, Tse-yun

An Approach for the Design of an Air Traffic Control System.

Syracuse University, Dept. of Electrical and Computer Engineering Report TR-73-14 (RADC-TR-75-64) March 1975 197p. AD-A008 795

Sophisticated air traffic control systems (ATCS) are becoming more and more urgently needed to accommodate increasing air traffic service demands and to resolve the various problems caused by such demands. Collision avoidance is discussed.

854. Yoder, James E. and Moser, Royce, Jr.

Midair Collisions: Aeromedical Considerations.

School of Aerospace Medicine Report No. SAM-TR-76-29 Revised August 1976 29p. AD-A030 409 N77-18122

Psychophysiologic factors which have a bearing on collision avoidance are discussed in greater detail in this revision of an earlier review.

855. Yodice, John S.

A Deadly Communications Trap.

AOPA Pilot vol. 19, no. 2, p. 80-81, February 1976

A midair collision near Port Columbus International Airport between a Piper Cherokee and a Beechcraft Bonanza has made for confusion in the interpretation of FAR 91.87. Question: Is approach control part of the control tower?

856. Young, L.B.

Statement of the Vice President of Bendix Corp.

U.S. Congress. Senate. Committee on Commerce Subcommittee on Aviation. Collision Avoidance and Pilot Warning Indicator Systems.

Hearing, 92nd Congress, Second Session, December 1, 1971 and February 29, 1972. Washington, D.C. GPO, 1972. p. 13 - 16, 19 - 21.

Recommends the FAA accelerate implementation of ARTS III, compatible automatic altitude reporting transponders be mandatory for all aircraft, as well as 2-way radio communications. That time/frequency CAS be the common national backup system; revise the flight rules from a collision avoidance viewpoint; develop voluntary PWI; and place sole responsibility in the FAA for the overall collision avoidance system design.

857. Zeiner, A.R., Brecher, G.A. and Gerathewohl, S.J.

Physiological Effects of Backscatter of High Intensity Light Pulses on the Human Pilot.

In: Aerospace Medical Association, Annual Scientific Meeting, 43rd, Bar Harbour, Fla., May 8-11, 1972, Preprints. p. 148, 149.

Aerospace Medicine vol. 43, no. 9, p. 1008 - 1013 September 1972

Attempt to determine the effects of brief high intensity light pulses from an anticollision light flashing at 1.27 Hz on a variety of physiological measures in a normal nonepileptic population. Since the subjects in the first experiment were not pilots, the experiment was repeated using instrument-rated pilots as subjects as well as an age-matched control group of nonpilots. The actual backscatter conditions were simulated more closely by using backscatter from manmade fog as a stimulus. Results indicate that physiological changes which are resistant to habituation take place under intense brief pulses of backscatter light.

858. Zeitlin, Andrew D.

Supporting Rationale and Updated Information for the Tri-Modal BCAS Engineering Requirement.

Mitre Corporation, METREK Division Contract DOT-FA69NS-162 Working Paper WP-12462 July 1977 21p.

Rationale is given for the numerical values that describe the initial and final environments in which the BCAS will operate, and performance goals in those environments. The BCAS test description is extended to include all modes of operation. Rationale is given for the requirements of the active mode. DABS Air-to-Air Interrogation and reply signal formats are detailed.

859. Zeller, Anchard F.

Two Objects Can't Occupy the Same Point in Space at the Same Time.

Aerospace Safety vol. 30, no. 3, p. 1, 25-27, March 1974

To date no known hardware has been developed which would assist the pilot in the final action stage of the perception/decision/ response sequence. In this, the information from the sensing system would automatically be fed into the control system and the aircraft would respond to these inputs without necessary pilot intervention. One limitation of all current hardware is that it is based on a cooperative concept. It is ineffective unless both aircraft have at least some elements of the equipment installed. The ideal collision avoidance system would be one which would be completely self-contained. With such a system, the aircraft so equipped could have positive assurance of collision-free flight, regardless of the equipment on other aircraft in the adjacent airspace.

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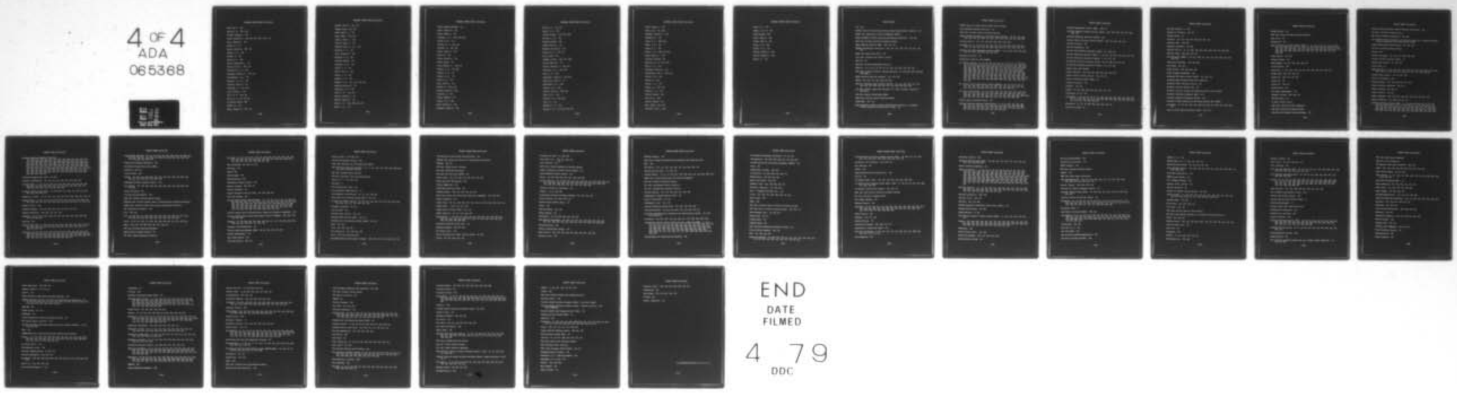

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